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ABSTRACT

This interdisciplinary environmental education classroom manual was designed with the needs of both educators and pupils in mind. The manual is a compilation of articles, activities, and resources which exemplifies methods of media and the philosophy pertinent to environmental education. The volume contains materials collected from a variety of sources: the U.S. Forest Service, the U.S. Department of Agriculture, Campfire Girls, educators and environmentalists. The manual is divided into five sections. Section A deals with the philosophy and concepts of environmental education and program development. Symposium abstracts, curriculum guidelines, and program guidelines are included. Section B deals with lesson plans and provides the teacher with information methods and sample plans. The activities included in this section cover environmental education in various subject areas, problem solving, investigations of both the natural and man-made environments, and a model for an environmental education program. Section C contains listings of resource books, reprints, simulations, kits, graphics, film transparencies, silent films, and film loops: Section D contains an aids bibliography compiled for the U.S. Office of Education and presents a comprehensive listing of materials prepared for teachers. A further listing of environmental films is included in Section E. (TK)

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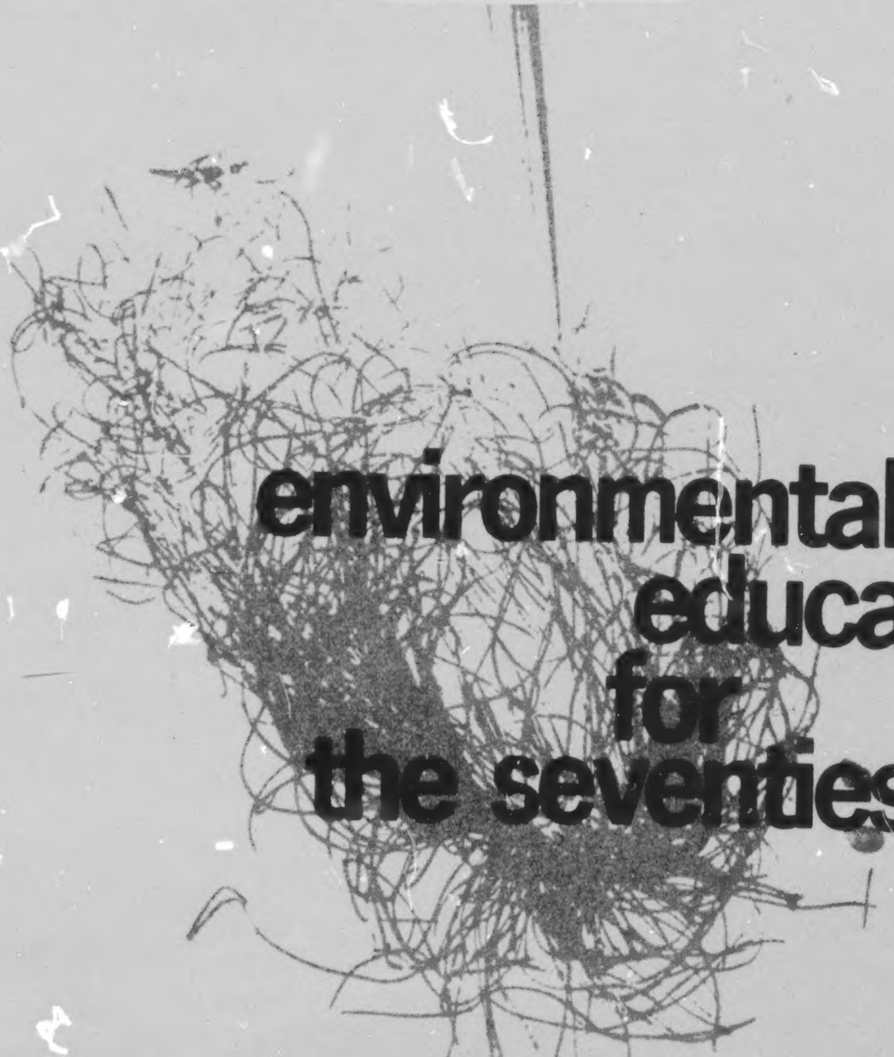

environmental education for the seventies

natural resources
and
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ENVIRONMENTAL EDUCATION FOR THE SEVENTIES

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September 1, 1973

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PREFACE TO THE SECOND EDITION

The workshop "Environmental Education for the Seventies" has come and gone, and the manuals developed for it are now out of print. Response to the manuals suggested high utility, and we were encouraged to produce more copies. We took the opportunity not to reprint the same material, but to expand the content and update most of the elements in the original edition.

Environmental education has matured rapidly, and a consensus is appearing that has serious implications for education in general. Firstly, environmental education is here to stay. It may (hopefully will) become a part of many disciplines at all grade levels. This may result in loss of identity as a discrete subject matter area, but the relationship of environmental education to the future is so important that it cannot be avoided.

By its nature it is also pervasive -- its impact is so broad that it is relevant to life all around us, both qualitatively and quantitatively. It seems clear, too, that technology and science cannot solve all problems, but that attitudes are extremely important. People are a key factor in helping determine their destiny.

For environmental education to be successful it must be integrated into most curricula. Activities cannot be limited to the high school laboratory but should be incorporated into other learning situations as well, both indoors and out. Among the approaches currently being emphasized is problem solving, and this is not only compatible with environmental education but a necessary component.

There is a need to implement an environmental education structure at district and perhaps state levels to design and make materials available in resource centers. Such an approach could be vastly more efficient than each teacher inventing his own program.

Finally, it is evident that inservice training is needed for guidance and exchange of ideas, because for many educators concepts of environmental education are new.

This book is a collection of ideas and is intended to exemplify the philosophy, methods and media pertinent to environmental education today. We genuinely hope it will be a service to educators and pupils.

Ronald L. Giese

George R. Parker

Barbara Binhammer

ACKNOWLEDGEMENTS

Within this manual there are important components which were developed by others who were willing to share their information so that we could bring together in a single book related materials in environmental education:

Curriculum Guidelines and Sample Lesson Plans for Environmental Education originated from the Association of Classroom Teachers, National Education Association.

Building a Live Program is taken from the CDC Handbook entitled "Focus on Environmental Education" published by the Curriculum Development Council for Southern New Jersey, Glassboro State College.

Things to Know were compiled from introductory elements of the publication "Conservation" by Campfire Girls, Inc.

The Environmental Education Bibliography was originally developed by the Massachusetts Audubon Society for the Office of Environmental Education, U. S. Office of Education, HEW.

Environmental Involvement units were developed by the Dow Chemical Company.

Included in the revised manual are additional materials made available to us by those who are vitally involved in environmental education.

United States Forest Service materials were selected from among those used at a Forest Service workshop at the Higgins Lake, Michigan Conservation Center.

Developing An Environmental Education Program, K-12 was used with the permission of Dr. William Stapp of the School of Natural Resources, University of Michigan.

Science Study Aids are prepared by the Educational Services Branch of the U. S. Department of Agriculture.

Herbert L. Archibald, assistant professor of wildlife ecology at Purdue University shared with us several of the lesson plans developed for use in his conservation of natural resources classes.

We are indebted to all these organizations and individuals for permission to reproduce their materials.

Abstract

THE STATE OF ENVIRONMENTAL AFFAIRS

Ronald L. Giese

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The environmental era can hardly be escaped -- we are deluged daily with information of all sorts in the mass media. Doomists predict the end of the world, but even responsible people conclude -- and the evidence is abundant -- that this planet and its occupants face some serious difficulties in the years ahead. The purpose of this workshop is to put into perspective a few of the important aspects of environmental problems viewed from history, economics, political science, humanities, ecology and education and relate them to classroom activities.

Among the factors leading to the present state of environmental affairs are industrialization and population. Beginning in the 18th century a few basic inventions -- the flying shuttle, spinning jenny and cotton gin -- changed a slow manual weaving process into an impressive mechanized textile industry. Then came the steam engine, the coke process was discovered, and a chain reaction of other inventions along with mass production resulted in unprecendented goods and services and a standard of living never dreamed of. Fossil fuels supplied the industrial age with energy as well as the products of combustion.

Population factors are also significant. The density of humans has increased rapidly; in 1900 there were 14 times as many Americans as compared with 1800, and by 1970 there were 38 times as many. The distribution of these people causes special problems. One hundred years ago, 20% of the people lived in cities, and now nearly 80% reside in cities; in fact two-thirds of our population is concentrated on 2% of the land area.

The modern western society with its high standard of living shows an almost insatiable demand for resources. The term "autocatalysis" describes these demands and many other environmental problems whereby variables increase exponentially. For example population is increasing at an increasing rate. Many other phenomena are following the same trend:

- Overall energy consumption doubles in about 12 years
- Electric power growth of 9% a year is doubling every 8 years
- Trash volume is increasing faster than the population
- Motor vehicles follow the same pattern (and impose the major source of)
- Air pollutants
- Highways and other land conversion required by automobiles
- Water demands are escalating
- Sewage disposal problems have become critical in larger cities.

Traditionally, man has solved his environmental problems by emigration and intensified environmental conquest. Now we must come to terms with environmental control and the cost will be social and intellectual as well as financial. Implied is intelligent assessment, a new understanding of the dynamics of our environment and new attitudes about our life style. Teachers will play a crucial role in each of these areas.

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Abstract

LITERATURE AND THE ENVIRONMENT

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It is possible to study literature quite independently of the historical, biographical and social environment which produced it. Indeed, much of the formal criticism of the past three decades, has done just this. But while formal criticism has virtues in providing the student with the tools of literary analysis, it fails to meet the broader needs of many young people today. An alternative to purely formal criticism -- the examination of literature within the social and intellectual context of the society in which it was produced, may give students more profound insight into certain recurring themes in human culture. This can be as true of man's attitude toward his environment as of any other fundamental theme.

It is even possible to organize courses thematically about certain environmental issues rather than depending on the chronological or genre distinctions which are commonly used as organizing principles.

Formal literary criticism, by ignoring questions of comparative value structures, does not permit the teacher of literature to relate his discipline strongly or directly with environmental concerns. For these reasons, it may be that formal critical techniques should be studied only at advanced levels and that the underlying value structure of literary works should be a central concern of study at the primary, secondary, and beginning college levels.

Even more important is the study of literature as an accumulation of human value judgments. It is, after all, human values which determine our judgment of what is proper use and what is misuse of the environment. Different cultures have at different times developed widely disparate views of the character of the natural world and man's role in it. It is only in the context of these views that human environmental intervention can be judged and evaluated.

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See especially:

White, Lynn, Jr., The Historical Roots of our Ecologic Crisis.

Sears, Paul B., The Steady State: Physical Law and Moral Choice.

Abstract

POLITICAL SCIENCE AND ENVIRONMENTAL EDUCATION

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Political Science encompasses the framework within which social solutions to our present and future environmental problems must come. Citizens must be able to think intelligently about the policy questions which must be resolved. It is part of the responsibility and the challenge of public school education to provide the tools, skills and knowledge which will prove useful in addressing and solving these questions. There are fundamental questions about the nature of the problem that need to be raised and also knowledge that has to be acquired, critical skills that must be developed and a broad understanding of the nature of the problem for intelligent judgements to be made. Political science as a discipline can make some significant contributions in exploring and analyzing the problem and its possible alternative solutions.

Some basic questions have to be raised:

1. **Does our political system facilitate the solution (structure) of social-political** problems?
2. What is the relationship between technical and political problems and their solution?
3. What are the international implications of the environmental crisis?
4. What criteria ought to be applied in making decisions affecting the environment? What kind of value system is being applied? What types of value choices are being made?
5. How responsive, how effective, how democratic is the process of decision-making and the resulting policy in this area?
6. What is the function of the teacher in this area? What kind of tools are available, what kinds of tools can be developed to sensitize students in this area?

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Abstract

ECONOMIC STRUCTURE NEEDED FOR ENVIRONMENTAL QUALITY

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The present day situation with respect to environmental quality is not unexpected from an economic viewpoint. Both producers and consumers basically prefer more to less, and their maximization endeavors lead to maximum use of lower priced or unlimited resources. The environmental media have been viewed as unlimited and as free goods. Environmental media have been the "dumping grounds" for residuals of production and consumption activities. No social or economic problems arise as long as there is a scarcity of people and abundant environmental media are not valued highly by the affected people. But currently there are high concentrations of people in many areas, and the environmental media are no longer considered unlimited and free. Social priorities have changed and social costs associated with the use of environmental media are being recognized.

Externalities are at the heart of today's environmental problems. Externalities arise when the production or consumption activities of others (producers or consumers) are altered by effects which are not deliberately created but are unintended or incidental by-products of some otherwise legitimate activity and those affected have no control over the activity. Externalities may be positive (amenities or gains) or negative (external costs). External costs are the ones of concern in environmental issues -- society bearing the costs of environmental deterioration.

Residuals resulting from consumption and production processes may create severe external costs, and these residuals deserve special consideration. They are normal and indeed an inevitable part of consumption and production processes. The economic significance of these residuals tends to increase as economic development proceeds and the ability of the environment to receive and assimilate them is an important resource of increasing value. Residuals and desirable attributes (services) are joint entities embodied in materials and products ranging from raw materials to final consumer goods. In production the desirable attributes embodied in inputs add value in the manufacturing or production process and the desirable attributes embodied in consumption goods satisfy consumers' wants. The materials and products are exchanged in the economic system because of the embodied services. However, the services can't be attained without the residuals. And at some time in some form at some place in some concentration these residuals enter the environmental media. The availability and quality of resources as well as the quality of the environmental media themselves may be severely affected. This brings to the forefront social and private costs and benefits in terms of just who will bear these costs and who will reap the benefits. In many cases it is clear that social costs and private benefits are high relative to the social benefits and private costs.

One of the major difficulties with handling externalities associated with residuals is that no social or economic institutions exist that permit common property resources such as air, streams, lakes, and oceans to be "owned" and exchanged in the market place. Processes of private

exchange have not assigned accurate relative values to alternative uses of the common property resources. There is a need for institutional innovations capable of establishing meaningful property rights for common property resources and economic institutions which will permit pricing and allocation of common property resources among alternative uses according to their values at the margin. Rather substantial effort is being focused in this direction.

In the '70s considerable emphasis will be given to internalizing externalities associated with residuals of production and consumption. The focus is on making those responsible for or enjoying the benefits of residuals and subsequent externalities in some way pay for them. The economic incentive does not exist for external costs to be absorbed voluntarily. In some cases this will have to be accomplished through imposed user charges or through taxation. In other cases outright governmental regulation will be used. In some cases incentives to invest in anti-pollution facilities such as subsidies and tax and other special concessions. With all of these types of measures the differential impacts which these may have and how they might influence the competitive position of a region or a group of producers or consumers are key economic issues.

Finally, improving environmental quality is not without a price. It is not an all or nothing proposition as implied by extreme positions which people often take with respect to environmental quality. There are trade-offs concerning how much of a "cleaner environment" we really want and what are we willing to give up to achieve it which have to be considered. At certain levels the marginal costs of a more improved quality of environment are astronomical. Initial costs of adjustments to higher quality standards are borne by producers but ultimately consumers, you and I, pay for the higher quality environment. Consumers ultimately pay through higher prices of goods and services, lower dividends, or foregone products and services.

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Abstract

HISTORY TEACHING AND THE ENVIRONMENT CONTROVERSY

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History teachers seem occasionally to be perplexed about the role they should play in the current anxious debates over our environmental problems. At times the issues raised seem to be exclusively the province of botanists, physicists, chemists or urban experts. But this is only superficially true. There are at least two good reasons why historians have a lot to say about ecology. First, we got into our present fix by evolving economically, socially, and politically through time. This evolution has left its marks in the historical record. Those marks are beginning to be written into fairly accessible books and articles. Second, this newly emerging part of the historical record is one of the few "laboratories" which mankind has at its disposal for learning to understand its own behaviour, and the success or failure of its social "experiments." It is cheaper to study our ancestors' mistakes than to repeat them on our own.

This is not to say that problems in becoming an expert in "environmental history" do not persist. History has traditionally put more emphasis on political, military and diplomatic history, than on such topics as economic evolution, technological innovation, the social response to scientific theories, and the like. Much writing and researching in these areas has yet to be done. The information needed to do such studies sometimes is difficult or even almost impossible to come by. Scribes, clerks and scholars have sometimes ignored revolutions in the crafts, or in science that occurred under their very noses, assuming that such matters were the business of inferior classes. Nonetheless, works on such topics are appearing with increasing frequency, and will probably become more important in the overall scope of historical inquiry as time goes on.

Once into the materials which bear on environmental issues, the historian will begin to see patterns and critical points emerge. These might include:

1. The uneven rate of technological innovation in history. Some eras are rich in invention; at other times, centuries pass when there seems to be "nothing new under the sun." Both sorts of historical periods are useful from today's viewpoint, for the stable periods may provide clues for living in harmony with nature; while the innovative eras, by the study of the adjustments which they undergo, can provide perhaps suggestions for the current steps to be taken to "tame" technology.

2. Let us look at some specific further instances from the historical record. What, for instance, was the relationship between technical innovation in the Middle Ages, and the Black Death which struck them in the fourteenth century? What are we to make of the Industrial Revolution, which has given us smoky skies, dirty water, cities and slums, and a tremendously advanced standard of living? Did environmental degradation play any role in the decline and fall of the great civilizations of antiquity?

3. Finally, let us ask whether the consideration of environmental problems, and society's reaction to them, may not help us as historians to understand more clearly how social systems work. Thus these sorts of studies might not only help in alleviating twentieth century problems, but increase our knowledge of history as well.

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Abstract

ECOLOGICAL CONCEPTS AND ENVIRONMENTAL QUALITY

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In this time of environmental concern, it seems that everyone is an ecologist. Actually the science of ecology is only a partial answer to our environmental problems. It is the underlying science on which man should base his cultural systems in that it will, hopefully, provide boundaries and guidelines for the use of the biosphere.

Ecology has been called the synthesizing science since it draws upon other scientific disciplines for understanding. Professional ecologists define ecology as the study of the structure and function of ecosystems. The ecosystem is the basic functional unit of ecology and is defined as the complex of organisms in a given area interacting with each other and their physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity and material cycles. Therefore, an ecosystem may be a lake, city, forest, watershed, or the whole biosphere.

Although the study of the earth's ecosystems is far from complete, enough is now known to arrive at some conclusions if man is to achieve and maintain a quality environment:

1. The ecosystems on earth today are the product of millions of years of evolutionary development resulting in greater diversity, conservation of energy, and recycling of nutrients. Man's actions tend to reverse these processes.

2. The organisms occupying the various regional ecosystems (biomes) of the earth's biosphere are adapted to the prevailing environmental conditions of the region in which they are found. Man's actions causing change in these environmental conditions are so rapid that many species cannot adapt.

3. Within any major ecosystem type, there are always disturbance ecosystems and mature or climax ecosystems. Man's actions are now increasing the size of disturbance ecosystems at the expense of mature ecosystems.

4. Disturbance ecosystems characteristically have greater net productivity, less diversity, greater loss of materials, greater domination by species generalists, and less stability than mature ecosystems. Therefore, disturbed ecosystems are needed for the production of food and fiber, while mature ecosystems are needed for stability. The latter are rapidly being lost.

5. There are limits to the rate at which any ecosystem can receive wastes and return them in a usable form. Man is increasing the rate of flow and changing the form of wastes, causing further degradation of ecosystems. This degradation may result in changes which reduce the value of these ecosystems to man's needs.

6. Changes in ecosystems can be irreversible. For example, the loss of the genetic material of extinct species cannot be reconstituted.

7. The interdependence and complexity of ecosystems may prevent the side effects of man's actions from being discovered immediately.

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Abstract

THE STUDY OF HISTORY AND THE ENVIRONMENT AS IT RELATES TO ENVIRONMENTAL EDUCATION IN THE CLASSROOM

Harold Trout

Tippecanoe School Corporation

I. History and Environment

"The natural environment has played an intricate role in the development of the United States. In teaching American history, it would be unthinkable to disregard the geographical factors that were involved in the formation of the nation, for the geography of yesterday may be an important causative factor in the history of today. Failure to teach such relationships may result not only in an injustice to the student but in his ultimate disinterest and apathy."*

Students of history need to understand the relationship of such factors as location, climate, and topography as they study how resources are utilized in the building of a great nation.

II. Concepts Emphasized -- Natural Resources

1. The vast natural resources were and continue to be a factor in the United States being a great nation.
   - a. Productive soil
   - b. Great coniferous and deciduous forests
   - c. Minerals fuels: coal, petroleum, and natural gas
   - d. Primary minerals: iron, copper, lead, zinc, uranium, gold and silver
   - e. Enormous quantities of fresh water
2. Lack of intelligent usage
   - a. Forest fires, some deliberately set
   - b. Pollution of streams
   - c. Extravagant and wasteful mining practices
3. Our agricultural history has been a turbulent one.
   - a. Laws related to the land have historically been passed by rural persons.
   - b. Rural governing bodies have lacked knowledge of soils and climate. The result has often been a disaster by the loss of fertile topsoil.
4. As resources diminish, the United States becomes more dependent upon the rest of the world. The threat of war to control the remaining resources will pose a threat to mankind's survival and to the goal of peace through understanding of national interdependence.

III. The frontier Attitude Toward the Resources at Hand

- A. The immediate need
- B. Self-preservation
- C. Scarcity and utility
- D. Concept of private ownership and the profit motive

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*John W. Morris, 1961. "Use of Geography in Teaching American History," 31st Yearbook, National Council for the Social Studies, Ch. XXII. Washington, D. C.

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Chapter 6 has an excellent treatment of our early government land policy and the treatment of the Indians among other aspects of early expansion.

All of the listed materials are excepted from Social Studies School Service Publications:

SIMULATIONS

Page 67 -- Enterprise
Balances

SMALL GROUP GAMES

Page 71 -- Smog

DOCUMENTARY PHOTO AIDS

Page 78 -- Series 2 - The American West

TRANSPARENCY - Duplicating Books

Page 80 -- Man and His Environment

FILMSTRIPS

Page 99 -- Our Economic System
Our National Resources

Page 102 -- Current Affairs Sound Filmstrip
Conservation Through Recycling Parts 1 & 2
Ecology

Page 104 -- New York Times Sound Filmstrips

Page 105 -- The Last Frontier
Crisis of the Environment, Series of 5 Sound Filmstrips:

1. Man: An Endangered Species
2. Breaking the Biological Strand
3. Vanishing Species
4. Preserve and Protect
5. The Population Explosion

Warren Schloot Production, Sound Filmstrips:

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1. What is Ecology?
2. The Beer Can by the Highway
3. The Story of the Everglades
4. The Oceans
5. Water Pollution
6. Air Pollution
7. Ecology at Work
8. The Deciduous Forest
9. Soil

PAPERBACKS ON ECOLOGY

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1.	Mikes World -- Your World -- Educational Ventures, EV 102	.75
2.	What's Ecology? Clifford Humphrey and Robert Evans, Hubbard-HB 2015	1.50
3.	The Ecology Action Guide -- What You Can Do to Assure Your Own Survival, by Alan Bock, Nash 1186	1.95
4.	The Vanishing Landscape -- A Collection of Essays on Pollution and Environmental Control, Donald Douglas and John R. Stewart, National Textbook, NT 5135	3.60
5.	The Environmental Crisis, Man's Struggle to Live with Himself, Ed. Harold W. Helfrick, Jr., Yale University Press YFL	1.95
6.	Our Environment Can Be Saved, Nelson Rockefeller, Doubleday	2.50
7.	The Ecological Citizen, Dirck Van Sickle, Perennial, HR 211	1.25
8.	The Politics of Ecology, James Ridgeway, Dutton DU 304	1.75
9.	The Fight For Quiet, Theodore Berland, Spectrum	2.45
10.	The Users Guide to the Protection of the Environment, Paul Swatek, Ballantine	1.25
11.	Our Mistreated World: Case Histories of Man's Pillaging of Nature, Eds. of Wall Street Journal, Dow Jones	1.95
12.	Moment in the Sun: A Report on the Deteriorating Quality of the American Environment, Robert Reinow and Leona Train Reinow Sierra Club -- Ballantine	.95
13.	The Frail Ocean, Wesley Marx, Sierra Club -- Ballantine	.95

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14.	Nader Reports	
	RN3 -- Interstate Commerce Omission (sic)	1.45
	RN4 -- The Chemical Feast	.95
	RN6 -- Vanishing Air	.95
15.	The Water Lords, Bantam, BAN 7119	1.95
16.	Old Age: The Last Segregation, Claire Townsend, Bantam, BAN 7120	1.95
17.	The Population Bomb. Population Control or Race to Oblivion, Paul Ehrlich, Sierra Club -- Ballantine	.95
18.	Population: Too Many Americans, Lincoln H. and Alice Taylor Day, Delta DLT8953	1.95
19.	How to Kill Population, Edward Pohlman, Westminister WM 24933	2.65
20.	The American Population Debate, Daniel Callahan, Doubleday DD 797	2.50
21.	People: An Introduction to the Study of Population, Robert Cook and Jane Lecht, Columbia	1.50
22.	The Ecology Controversy, GP 3	1.65

Abstract

ENVIRONMENTAL EDUCATION IN THE CLASSROOM

James L. Barth
Department of Education
Purdue University

"....(they) cut down my timber; they kill my buffalo; and when I see that my heart feels like bursting; I feel sorry ... Has the white man become a child that he should recklessly kill and not eat? When the red men slay game, they do so that they may live and not starve."

- Satanta, Chief of the Kiowas

"Before you people ever crossed the ocean to come to this country, and from that time to this, you have never proposed to buy a country that was equal to this in riches. My friends, this country that you have come to buy is the best country that we have ..."

- Chief Joseph of the Nez Perce

WESTERN HISTORY IS A MIRROR OF YOUR IMAGE

The words and the values expressed in the quotes above seem a bit strange. They are strange ideas because they represent a different set of values, a different way of living on the earth. The values of the western culture suggest that we claim, own, and use the land for the benefits which can be claimed from it. We suggest that American History is a demonstration of the western man's set of values. The taming of the wilds, the winning of the west, the application of manifest destiny represent a picture of our ancestors and no less an image of ourselves.

IS THE PROBLEM A PROBLEM?

When is a problem a problem to your students? Does it become a problem when you tell the students it is a problem? Suppose you were to tell your class that the quality of the environment was a continuing and growing problem, suppose you brought before the class supporting information, and finally were to hold a discussion with your students followed by your summary on why they ought to be concerned. What evidence we have seems to suggest that students neither perceive a problem nor find reasons to relate to problems that they do not personally identify. To identify a problem is not to give the students a problem.

From the Social Studies School Service Catalog, 1972

Page 4 --	Teacher Resource Materials	
	Environmental Methods Curriculum Guide: Western Cultural Tradition and Human Survival	$3.75
Page 8 --	Joint Council on Economic Education	
	The Economics of the Oceans	1.25
Page 10 --	Public Affairs Pamphlets	
	Noise - The Third Pollution	.21
	An Environment Fit for People	.21
	The Battle for Clean Air	.21
	A New Look at Our Crowded World	.21
Page 13 --	Problems of American Society	
	Air and Water Pollution	.95
	The Traffic Jam	.95
Page 16 --	Congressional Quarterly Classroom Publications	
	Man's Control of the Environment	4.00
Page 17 --	The Urban Environment: Editorial Research Reports	3.95
Page 18 --	Contemporary Problems	
	Population Control: A Study of Social Conflict	7.50
Page 21 --	Current American Problems	
	Operating Manual for Spaceship Earth	1.95
Page 22 --	Mike's World - Your World: A Look at Our Environment	.75
	What's Ecology?	1.50
	The Ecology Action Guide: What You Can Do to Assure Your Own Survival	1.95
	The Vanishing Landscape: A Collection of Essays on Pollution and Environmental Control	3.60
	The Environmental Crisis	1.95
	Our Environment Can Be Saved	2.50
	The Ecological Citizen	1.25
	The Politics of Ecology	1.75
	The Fight for Quiet	2.95
	The Ecological Conscience: Values for Survival	2.45
	The User's Guide to the Protection of the Environment	1.25
	Our Mistreated World: Case Histories of Man's Pillaging of Nature	1.95
	Moment in the Sun: A Report on the Deteriorating Quality of the American Environment	.95
	The Frail Ocean	.95
Page 23 --	Ralph Nader Summer Study Group Reports: Interstate Commerce Omission (sic)	1.45

The Chemical Feast	.95
Vanishing Air	.95
The Water Lords: Ralph Nader's Study Group Report on Industry and Environmental Crisis	1.95
Old Age: The Last Segregation	1.95
The Population Bomb: Population Control or Race to Oblivion?	.95
Too Many Americans	1.95
How to Kill Population	2.6[illegible]
The American Population Debate	2.50
People! An Introduction to the Study of Population	1.50

Other Environmental Education Materials:

Page 67 --	Balance (simulation game)	10.00
Page 71 --	Small Group Games	10.00
Page 77 --	Ecology (photo-aids)	14.00
Page 101 --	Environmental Pollution (filmstrips)	40.00
Page 102 --	Ecology (filmstrip)	17.50
Page 105 --	Crisis of the Environment (filmstrips)	97.50
Page 107 --	Warren Schloat Productions (sound filmstrips)	
Page 128 --	Resource Kit	38.50

CURRICULUM GUIDELINES FOR ENVIRONMENTAL EDUCATION*

Gertrude Tempe, Curriculum Coordinator
Madison Public Schools, New Jersey

I. The first guidelines recommended by the NEA Task Force on Environmental Education to be applied to environmental curriculum is to ASSIST CHILDREN, YOUTH AND ADULTS IN ACQUIRING ENVIRONMENTAL LITERACY, ETHICAL STANDARDS, AND BEHAVIORAL PATTERNS WHICH RECOGNIZE MAN'S PERSONAL RESPONSIBILITY TO A QUALITY ENVIRONMENT.

The more dependent our lives are upon any natural resource of our environment the more we take that resource for granted assuming that it will always be there. The old proverb that says, "You never miss the water till the well runs dry," is true of all the absolutely essential life-supporting resources of our environment: air, water, green-growing things, the soil, sunshine.

With scientists warning that the potable water in the well may run dry; the oxygen in the air may become in short supply; the green-growing things may die from the poisons we are spewing into the air or the oceans; the arable land is fast being eroded, ruined or used for other purposes than to produce food; it is time to turn efforts to building environmental literacy, developing ethical standards, and behavioral patterns that will preserve and improve essential environmental resources. It is mandatory that environmental education teach that resources be viewed as a community of which many is part -- not as a commodity to exploit.

Primary grades or even pre-school is not too soon to begin developing awareness and appreciation of these resources. When hands are washed, clothes cleaned, lawns watered, wading pools enjoyed, very young children can be taught to value water and to consider it too precious to waste by letting faucets run or playing with the hose. Children in their early years of school can study their own family and community water resource and understand the value of an adequate water supply by recognizing how essential it is to their well-being. They can begin to visualize what would happen to them individually if there was no water to quench thirst, in which to bathe, to flush toilets. They begin to realize what would happen if a community had no water supply with which to fight fires. Respect for and care in use of the community's supply of water are the behavior patterns that can be developed in young children from a curriculum based upon real life experiences.

As children reach middle grades, junior high and high school, their attention and study can be directed toward more complex problems related to obtaining and maintaining an adequate supply of water for all people. Through the study of geography, earth science, or civics, students in the junior high or middle school can make successful studies of watershed areas, beginning with their own local area and extending to a study of the important watershed areas of the nation and of the world. The study should include not only the geographic features but the volume of water in relationship to the needs of communities along its course, including water as a sustenance resource for individuals, households and cities, and the water needs of agriculture, industry and commerce along its waterways. High school students can delve into water pollution problems of their own and other communities in either science or social studies classes. Through constantly enlarging their study of water they gain awareness of man's dependence including the very existence of his cities and of life itself.

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*Selected excerpts from the presentation "Environmental Education: Role of the United Teaching Profession" at Detroit, Michigan, June 28, 1971. Reproduced by permission of Association of Classroom Teachers.

A second phase of environmental literacy is to help children, youth, and adults understand the workings of the great cycles and processes through which earth constantly renews essential resources, providing man does not interfere.

The great water cycle, energized by the sun, is the most massive physical event that takes place on earth. Children in the middle grades can understand how the fresh water supply of the earth is renewed by the continuous process of water vapor being lifted from oceans, circulated by winds, condensed by temperature changes, precipitated to earth in the various forms of rains or snow, and eventually returned to the ocean. Through a study of this cycle students begin to understand the dependence of the 1/4 land area of the earth upon the 3/4 water area for the maintenance of a constant supply of fresh water. The degree of damage man can do to the ocean before it ceases to perform this and other functions must concern the generation of children now in school.

Another great cycle which must be understood and kept functioning is that created by the photosynthesis process in green plants. Through this great chemical event hundreds of tons of carbon from the waste product of carbon dioxide combines with hydrogen from water and becomes forms of basic food carbohydrates while at the same time part of the oxygen is released into the air. This cycle, too, is set in operation by the light of the sun. Through it the oxygen of the air is constantly renewed provided man does not interfere with the photosynthetic process. The alarming fact is that man is interfering.

It is estimated that all the plants growing in the U.S. cannot replenish more than 60 per cent of the oxygen carried by the winds from the Pacific Ocean where the phytoplankton is constantly carrying on the process of photosynthesis. [1]

It is known that the oceans are the final depository of chemical wastes, and alarm has spread that DDT is found in fish caught in the waters of the Antarctic Ocean. But now it is becoming apparent the DDT inhibits the photosynthesis of marine phytoplankton. [2] It is not yet known the extent to which it may cause the oxygen supply to be diminished through the amount of DDT pesticides that will finally be washed into the oceans. Whatever the effect, today's school children will have to cope with the situation.

To avoid man's unwitting and damaging interference with these and other life-supporting, resource-renewing cycles, understanding of the conditions that keep these cycles operative must become the common knowledge of every citizen. Therefore, this must be a part of the common school curriculum instead of being relegated only to a high school biology or earth science course. Children in the middle grades are fascinated by the study of these cycles and can develop a deep concern that

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1/ Cole, LaMont C., Spring 1970. "Are We Running Out of Oxygen", Catalyst for Environmental Quality, 2-4.

2/ Ibid.

man does not interfere with or destroy the processes by which resources are renewed.

A knowledgeable citizenry can insure that industry, technology, or styles of living do not develop in such a manner as to disrupt or damage these great cycles or processes that keep the earth habitable.

Questions raised regarding the ecological effects of the SST and concern for environmental damage that may result from development of oil resources in the Arctic are beginning indications of the type of questions which must be answered before a project is developed and set in operation not afterwards.

Curriculum must not only permit but encourage students to question and challenge events which have been allowed to happen: strip mining, pollution of rivers, ocean dumping of nuclear waste, and a long list of other irreparable damages to the environment. Classroom teachers must help students challenge what has already happened and stimulate development of attitudes that will insist upon a critical examination of every proposed project to determine its full effects upon the environment before it is begun.

II. The second Task Force guideline calls upon education to encourage students to EXAMINE LOCAL, REGIONAL, NATIONAL, AND GLOBAL EFFECTS OF MAN'S USES OF TECHNOLOGY UPON THE NATURAL ENVIRONMENT. Students must see problems not only in the broad spectrum of a course in ecology, but also as related to specific situations. Their awareness of what is happening on all levels - local, regional, national, and global - must be built and help given to find channels through which to work for improvement.

Students must be taken out of the classroom into the world of real life around them and permitted to see what is happening, to question it, to express their concerns, and to seek alternative ways of dealing with problems of their own neighborhoods and communities. Litter, parks, playground needs, the indiscriminate use of sprays, the disposal of garbage are all legitimate areas of study for elementary school children. They can take pictures and write reports of what they see, or send letters to town authorities pointing out their concerns. Older children can engage in a study of the more complex problems of a community such as sewage and solid waste disposal, neglected and unsightly areas, and housing problems. Their findings should be conveyed to interested groups, organizations, and governing bodies. Elected officials are often anxious to be on record as responsive to children and to environmental problems and through such means the children and youth learn the legitimate approaches for trying to effect change.

Students must not be permitted to stop with a study of or concern for their local community. They must be guided into realization that geographic regions transcend political boundaries and to look at a problem as it relates to the region of which they are a part. An entire watershed must be considered as a whole, not segmented into county or state areas.

Likewise curriculum must help students to look at the total national environmental problems. Elementary school children can make U.S. maps and spot the environmentally abused or endangered areas with clippings or pictures cut from newspapers and magazines, whether it be the mountains of Appalachia laid bare by strip mining, Lake Erie polluted by cities and industries, or San Francisco Bay filled in to provide prime real estate. Older children can keep files or notebooks on areas in the environmental news. High school students can gather statistics and information, and project alternative solutions to problems. School newspapers and bulletins can be developed to carry the students concern back to the parents and draw attention to national environmental issues.

Concern of the students must eventually go beyond the boundaries of the nation to the world as a whole. As a start students may trace the ocean currents to determine how DDT washed into the Hudson or the Columbia Rivers might reach the Antarctic. They may study the wind currents to try to project the path of nuclear fall-out exploded from any part of the earth. From these rather simple geographic studies of how pollution from any one source may spread around the globe, the student may be challenged to examine the industrial problems and the political issues involved in cleaning up global pollution.

In the next few years drastic action must be taken to avoid more contamination than earth can endure. These are the problems which the children now in school will face and they must be prepared to find facts, question why, and determine courses of action.

III. The third guideline suggests that teachers PREPARE PUPILS TO EVALUATE BROADLY ALL PROPOSED USES OF NATURAL RESOURCES AND TO QUESTION BASIC ECONOMIC AND POLITICAL ASSUMPTIONS WITHIN THE PERSPECTIVE OF HISTORIC USE AND MISUSE THROUGHOUT THE COUNTRY AND THE WORLD.

Early colonizers came to America for religious or political freedom. Others came to find economic security through taking up land, owning a home and having a means of livelihood. Still others came to seek wealth through exploiting the rich resources of the new world: land forests, furs or minerals. Growth became the symbol of progress: big cities, big factories, big industry. Today the symbol of progress and prosperity is an always upward swing of the Gross National Product. To maintain this upward trend of the GNP, man seems to be racing to exploit all the resources of the country and of the earth - the non-renewable as well as the renewable.

Iron has been the basic resource of much of heavy industry to build railroads and bridges, heavy machinery and cars. Many buildings are girded with iron or steel. War equipment is made of iron. Scientists tell us that iron reserves are no longer adequate for use on the grand scale of the past. Consideration of recycling the metal from worn out machinery, equipment and cars has only just begun while landscapes are littered with auto graveyards, old engines and discarded equipment abandoned to rust away.

Likewise supplies of fossil fuels are used up at a furious rate, which has sent oil men to all parts of the globe searching and attempting to get a corner on potential oil reserves in other countries. To obtain it political alliances are conditioned and compromises made that result in international situations. The belief seems to be that this course of action is necessary to supply this generation with a life style of affluence.

Few have felt responsibility to question personal consumption of products made from these natural resources. Three tons of iron and steel, which consume a gallon or two of gasoline, are driven to purchase a bag of groceries or children are chauffeured three blocks to school when growing bodies demand exercise. The roads into and out of cities are clogged carrying one person who could use mass transportation, or insist that mass transportation be provided. The warning Gifford Pinchot gave applies to the United States today.

> "A nation deprived of liberty may win it. A nation divided may be reunited: but a nation whose natural resources are destroyed must inevitably pay the penalty of poverty, degradation and decay."

The adult generation will probably finish life with only a little narrowing down of use of resources. But the pupils in school may be faced with forced development of an entirely new style of life, because earth's non-renewable resources have been consumed as though they were unlimited. Renewable resources are destroyed or used up faster than they can be renewed in many areas: forests, grasslands, and fresh pure water supplies.

Help must be afforded to students to examine the use of exhaustible renewable resources. They must understand processes, conditions, and time required for renewable resources to regenerate themselves: forests, fresh water, oxygen in the air.

Students must learn to question, to evaluate and to weigh immediate gains against permanent losses. Classroom teachers must help them develop life styles in harmony with a world of dwindling and misused resources. They must learn to collaborate with nature, not exploit it.

IV. The fourth guideline becomes even more important in light of the increasing trend to lower the voting age to 18. High school students will generally be voting citizens by the time they graduate. Schools must PRESENT THE LEGAL ISSUES AND THE NEED FOR ENFORCEMENT OF ENVIRONMENTAL LAWS. These young people must be aware of the issues involved and know the effective tools of legal procedures through which laws are made and can be changed.

Helping to improve local situations and to change local laws can be training ground for participation in effecting changes in larger areas - regionally, nationally and hopefully globally.

Even young children can gain satisfaction from having a share in righting wrongs, and it is the business of the united teaching profession to reach lawful ways to work for improvement.

V. Guideline number five calls for environmental curriculum to embrace the total environment. It must be more than outdoor education experience where children learn about the natural environment in a beautiful country area. It must include a study of the man-made environment and PROVIDE DIRECT EDUCATIONAL EXPERIENCE IN THE CULTURAL AND NATURAL ENVIRONMENTS INCLUDING URBAN PARKS AND OPEN SPACE, RECREATION AND WILDERNESS AREAS, JUNK YARDS AND DUMPS, POLLUTED STREAMS AND ERODED FIELDS, VACANT LOTS, EXPRESSWAYS.

To fully understand and lend their efforts to improve the total environment, students must have exposure to the ugliness of cities and industries, as well as pollution of wastes. They need the directed educational experiences of seeking alternate solutions.

Young suburban children, used to homes set in the middle of grassy lawns, with a play area and perhaps a family swimming pool in the back yard, can realize the crying need of the cities for playgrounds and open space only if they have seen and felt the limitation of the crowded city streets lined with buildings with no available space for play or relaxation.

Children and young people who see the family garbage conveniently picked up and carried away by a garbage truck cannot visualize the accumulation of solid wastes, disposal of which is becoming a threatening national problem. Only by seeing the growing immensity of the garbage dumps and the junk yards of their own and nearby communities can they realize the urgent need for families to reduce the amount of their individual solid wastes, for all reusable materials to be recycled, and for non-polluting methods to be found to handle wastes that cannot be reused.

As youth is taught to understand and appreciate earth's wonderful resources, they must also be made aware of the steady encroachment of garbage dumps, junk yards, and other natural environment destroying uses of land and water. There is satisfaction in living together in communities and cities but man-made environment with pollution of air, water, and land must be brought into harmony with natural environment, if cities are to survive.

VI. The sixth guideline calls upon school systems to INTEGRATE INTO THE PROCESS OF LEARNING AND TEACHING AT ALL GRADE LEVELS AND IN ALL SUBJECT AREAS THE BASIC PRINCIPLE OF ENVIRONMENTAL CONCERN, PRESERVATION AND IMPROVEMENT THROUGH EXAMINATION AND STUDY.

Environmental studies must be integrated into the total curriculum. Ecology cannot be just another subject in the curriculum, or an added subject. In the words of former Commissioner of Education, James Allen, "Environmental Education requires a synthesis or an integration into the natural sciences, the social sciences, the arts and the humanities."

Education for survival can become the theme for much of education. In history the use and depletion of resources in nations that were once great and wealthy can be taught. In the history of this country the use and the waste of the past and present can be traced.

Environmental education must prepare students to face the issues of hunger and population. For thousands of years lack of scientific and medical knowledge plus natural disasters caused the death rate to be only slightly less than the increasing population. Today the populations of the world are predicted to double and triple at alarming speeds.

According to the book of Genesis, "Be fruitful, multiply and replenish the earth" was a precept given to Noah after the flood, when the world presumably had no inhabitants except those on the Ark. In settling a new land - an almost empty continent - to early pioneers large families were useful and the young United States took pride in the increasing population. In today's world, the earth has already been populated beyond its capacity to give an abundant life to everyone.

There are also examples of effects upon people when population exceeds resources and space within a country. The Wall Street Journal of June 10, 1971 carried a description of the life of the teeming millions of Calcutta, India. One naturally recoils from such descriptions of hunger and misery - but to have a high concern for human life one must come to terms with the fact that there is a direct ratio between hunger and population.

Within the next 38 years[3] it is predicted that the population of the earth will double, unless those young people coming into maturity can know the facts and decide in favor of a quality life for a controlled population as against hunger for unlimited numbers.

The material for teaching Environmental Education is all around us - it is relevant, for it is life itself. Educators owe it to those they seek to educate to help them know the true facts, examine the problems, and develop alternative attitudes, actions, and styles of living enabling them to correct and maintain a quality environment - not only for themselves but for all generations to come who inherit the earth.

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[3] Ehrlich, Paul, 1968. Population Bomb.

AN ENVIRONMENTAL EDUCATION PROGRAM, (K-12)

by Dr. William B. Stapp and Ellen Vande Visse,
School of Natural Resources, University of Michigan

Introduction

We live in a closed life-support system. We have on our spaceship earth all of the air, water and land we will ever have. Space and resources are limited, yet since 1950 we have added one billion persons to an earth confronted with unprecedented environmental problems. United States comprises only 6 per cent of the world population yet we consume over 50 per cent of the world's natural resources.

As we enter the 1970's, we must realize that open land is being reduced. Large and middle-sized communities, many within complex urban regions, have evolved to where people are concentrated on a small portion of our land surface. (Over 70 per cent of this country's population resides on 1 1/2 per cent of our land surface.) With every passing day, more than 5 square miles of our nation's land surface is becoming urbanized. By 1985, 65 million more persons will reside in urban areas than in 1960. Within this same period of time, 41 million of our 53 million youth between the ages of 5 and 17 will be living in an urban setting (Freeman, 1968). It is estimated that by 1980, 8 out of every 10 Americans will probably live in an urban environment. Consequently, the independent rural-oriented living that once characterized our heritage is no longer a dominating influence on the lives of the great majority of our people.

Our urban areas are being plagued with complex biological-physical-social problems, such as the lack of comprehensive environmental planning, community blight, air and water pollution, traffic congestion and lack of institutional arrangements needed to cope effectively with such problems. Add to this the specter of even more people crowded into already highly dense urban areas as population growth continues. Man has but a short time to become trustee of his inherited land, air and water and to live in harmony with his environment. On how well and how soon he learns this lesson rests the fate of our existence on planet earth.

Root Causes Vs. Symptoms

To help resolve environmental problems that threaten the very existence of human life, our society needs to attack the problem at the "root level." In the past, we have primarily focused our national effort at the "Symptom level."

It is apparent that we will be facing the environmental problems of today in the future, and breeding new ones, until we identify the causes of our environmental crisis and develop action programs to resolve them.

It is evident that some important root causes of our environmental crisis rest in our present consumer and corporate behavioral patterns, our inability to cope with the population dilemma, and the lack of environmental policies that are responsive to an emerging ethic where man is living compatibly with his environment.

It is vitally important that citizens question the concept of consumerism as reflected in the present life style of Americans. It is easy to get caught up in a cycle created by corporations. For some businesses to be successful and continue, they need to force the consumer into a life style that is in conflict with man living harmoniously with his environment. Persons once needed products, but now the products need people to survive (Johnson, 1969). Citizens of all ages need to examine their way of life to determine the degree to which it reflects a commitment to both protect and enhance the environment. As an example, citizens should be active in solving traffic congestion both through the political process and by walking, bicycling, or using rapid transit rather than their cars. If the car must be used, driving pools should be formed. How much are we willing to personally sacrifice to provide a high quality environment?

Corporations and other non-governmental organizations must be more sensitive to the environment if we are to move toward a higher quality way of life. Both the private and public sectors need to spend more money to curb pollution. Furthermore, corporations and businesses must review their advertising policies in keeping with environmental concerns and maximize environmental safeguards.

Government, at all levels, must also become more responsible and responsive. Environmental responsibility is slim when the national defense budget takes 36 per cent of all tax dollars. Yet allocation to education is only 1 per cent, to housing and community development is 1 per cent, and to agriculture is 2 per cent in the national budget. Pollution abatement policy is weak, tangled in red tape or lacking altogether.

More responsible action toward the environment by citizens, corporations, businesses, and government is imperative. For in the last analysis, it is not possible for man to live harmoniously in a closed system without creating a "human community" that lives in a lasting balance with natural laws.

The responsibility of businesses, corporations and governments toward the environment rests within each of these bodies. It also rests with the citizen. As consumers, stockholders, voters, and advocates, citizens can help to establish sound environmental policy in various ways. Specifically, they can ask informed questions, at the proper time, of the right people. They can boycott a product and campaign for others to do likewise. They can serve on advisory and policy-making committees. They can support and be advocates for sound legislation directed at resolving environmental problems. Citizens can make decisions as they cast votes on environmental issues; as they elect representatives to policy-making bodies; as they directly act upon the environment itself.

The foundation for strong citizen action rests, to a large degree, on what happens in our homes and schools. Today's youth will soon be the citizens and voters whose decisions will affect not only the immediate environment in which they live, but also that of our nation. They will make the choices and cast the votes about recreation, transportation, beautification, water needs, and control of air and water pollution.

It is of critical importance to obtain better insight into approaches school systems might consider in assisting youth to become more sensitized to the environment and more inclined to participate in coping with environmental problems.

An appropriate role for school systems to assume in environmental education is to provide the opportunity for youth to explore their environment, both physically and intellectually, to obtain both the motivating concern and the factual knowledge regarding man's relation and responsibility to his environment. Schools have a responsibility to alert youth to emerging environmental problems and appropriate ways for citizens to act in helping to resolve these problems.

More specifically, if an important "root cause" of our environmental crisis is the life style of our people, then schools should be concerned with the development of values, beliefs, and attitudes that are compatible with man living harmoniously with his environment. Furthermore, skills need to be developed to enable students to play an effective role in achieving goals derived from his attitudes.

Citizens that have these values, attitudes and skills (which will be specified under goals section) should be more responsive and responsible in their personal behavioral patterns and more effective in changing corporate and governmental action so that it reflects an increased commitment toward a quality environment.

Major Obstacles to Environmental Education

It is important to recognize that the goals of environmental education are quite compatible with many of the recent curriculum reforms in traditional areas of study. Therefore, environmental educators should work cooperatively with curriculum innovators in all fields of study to help attain compatible goals. Many of the obstacles that confront environmental education are not unique -- they are inherent to the American educational system. We must identify these obstacles and team with other educators to resolve a common problem. At least four major obstacles need to be recognized and remedies recommended!

1. As the learner proceeds from kindergarten through the twelfth grade, educational material is increasingly organized around discipline and little emphasis is placed on problem-solving. This presents an obstacle because environmental education advocates an interdisciplinary, problem-solving approach to interdisciplinary problems. The problem-solving approach may need to be a more integral part of collegiate education before it can be successful at the elementary and secondary level. However, the problem-solving approach has been generally accepted by curriculum coordinators and school administrators, and it will be a matter of time before it becomes more widely used at the elementary and secondary level.

2. The curriculum is already crowded with subject matter material and it is difficult to persuade administrators to incorporate additional information into an already crowded school day. A rationale that has been used to counter this point, is that environmental education can serve to link subject matter fields and reinforce the existing curriculum. Environmental education also provides relevance for existing curriculum material.

3. As has been noted earlier, environmental education cannot avoid value questions, and public schools have generally stayed clear of value discussions, particularly those that might run counter to community norms and attitudes. It is generally espoused that teachers should not inculcate into the minds of students their own values which run counter to those normally accepted by the larger society within which they live. Environmental education has been most successful when teachers have examined value questions from different points of view and with total class participation.

4. There is a severe shortage of classroom teachers prepared to effectively integrate environmental education into instructional programs. The traditional approach to the teaching of environmental matters has been for the teacher to become knowledgeable about some aspect of the environment, and then to transfer this knowledge to the student through the lecture method. This process has not been successful in stimulating interest in environmental matters or helping the student to acquire values, beliefs, attitudes, or skills conducive to the development of an environmentally literate citizenry. Several leading environmental educators (Brandwein, 1971; Swan, 1970; Stapp, 1970) have advocated an approach where the teacher encourages class members to investigate their community environment in an effort to reinforce classroom material and to provide a working knowledge of the human eco-system. This represents a departure from a "read and discuss" procedure, to a process where class members view the environment firsthand, attend public hearings, gather relevant information, consider alternative solutions to problems identified, and advocate solutions through appropriate channels. This means that the prime role of the teacher is not to lecture on the environment, but rather to assist class members in acquiring information relevant to their environmental concerns.

Schools then, occupy a uniquely strategic position in producing environmentally literate citizens. The obstacles listed are considered and dealt with in the strategy mapped out below for the development of an environmental education curriculum.

STRATEGY FOR DEVELOPING AND IMPLEMENTING AN ENVIRONMENTAL EDUCATION PROGRAM, (K-12)

The following is a sequential strategy that seems most appropriate to date, given the considerations of situation and obstacles.

I. Establish an Environmental Education Advisory Committee

II. Obtain funds and hire an Environmental Education Coordinator

III. Formalize the responsibilities of the Advisory Committee and the Coordinator

IV. Establish the goals and sub-goals of the Environmental Education Program

V. Establish the operational objectives of the Environmental Education Program

VI. Establish strategy for curriculum development and implementation

VII. Establish in-service teacher education programs

VIII. Assist schools in developing their school sites

IX. Develop instruments to evaluate the effectiveness of the program

I. Establish an Environmental Education Advisory Committee

An essential component of most school programs is effective communication between the community and school system. The introduction of an environmental education program will require the involvement and preparation of administrators, teacher staff, students, and the community.

A major responsibility of an environmental education committee is to facilitate communications and provide guidance to the program. The committee should be composed of administrators, teachers representing various grade levels and subject areas, students, and citizens.

II. Obtain funds and hire an Environmental Education Coordinator

An example of funding for an environmental education program is found in the Kent Intermediate School District: In the spring of 1971, the combined Environmental Education Committee received a grant for $7,500 for 1 year from the Grand Rapids Foundation on the condition that a matching sum be raised by the community. The total is to fund the salary of a coordinator and the expenses of a 1-year pilot environmental education program in the Kent Intermediate School District. On July 15, this combined Environmental Education Committee hired an environmental education coordinator (Ellen Vande Visse) to provide leadership in the development of this program. Contributions to complete the fund-matching have been received from the National Sanitation Foundation through the Grand Rapids Environmental Quality Demonstration Project, Kent Intermediate District, and local businesses, industries, and organizations.

After funding such as this is completed for one experimental year, it is hoped that the program and coordinator position will be incorporated and funded by the school district.

III. Formalize the responsibilities of the Advisory Committee

The major responsibility of the Committee is to serve in an advisory capacity to the coordinator. It will be responsible for:

1) Generating new ideas, projects, and directions for the program;
2) Helping the coordinator in steering the direction and administration of the program;
3) Acting as a sounding board for policy, direction, and involvements;
4) Facilitating communication among schools, citizens, groups;
5) Helping direct and coordinate the community education aspects in conjunction with the academic facets of the program;
6) Raising money to finance the program;
7) Evaluating and critiquing the program.

The major responsibilities of the Environmental Education Coordinator are:

1) Administer the program;
2) Guide the development of the philosophy and structure of the program;
3) Become familiar with existing instructional material relevant to environmental education;

4) Develop curricula K-12;
5) Identify community resources, both physical and human, to serve the program;
6) Assist in the development and distribution of instructional material;
7) Train community citizens to serve the program;
8) Make presentations to parent-teacher and other community organizations regarding the program;
9) Help design and lead environmental field trips and be available to assist in classroom teaching of environmental topics;
10) Assist in the development of school sites to serve the program;
11) Offer in-service teacher education programs through workshops, extension courses, and the like;
12) Assist in the expansion of the school district's environmental education resources and instructional aids;
13) Maintain liaison between the school district's instructional programs and environmental organizations to provide coordination among the various efforts towards solving environmental problems.

IV. Establish the Goals and Sub-Goals of the Program

Without a clear statement of goals, an environmental education program would become a series of unrelated experiences, focusing on limited program objectives. A recommended goal for an environmental education program is to assist participants in becoming knowledgeable concerning the bio-physical environment and associated problems, aware of and skilled in solving these problems, and motivated to work toward their solution (Stapp, et al., 1969).

The major sub-goals (Stapp, et al., 1969) of the environmental education program are:

1. Cognitive - To assist the participants in acquiring a basic understanding of the following concepts that support and undergird the philosophy of spaceship earth:

    a) Closed System: We live in closed life-support system (except for solar energy). We have on our spaceship earth all the air, water and land we will ever have -- space and resources are limited.

    b) Ecosystem: Living organisms and their non-living environment are inseparably interrelated and interact upon each other. The exchange of material between the living and non-living parts follow circular paths. The relationships are complex and extremely vulnerable to sudden disturbances.

    c) Human Ecosystem: Man must have a clear understanding that he is an inseparable part of a system, consisting of man, culture, and the biophysical environment, and that man has the ability to alter the interrelationships of this system.

    d) Land Ethic: Man must develop an ecological conscience toward the environment which reflects a commitment of individual and group responsibility to future generations. He must develop an ethic where man is not a conqueror of the land-community but a citizen of it. Only when each person and community acts in a responsible, ecologically-conscious manner will we be able to live in harmony with, and within, our environment.

e) Population: Our earth is threatened and challenged by our rapidly increasing human population. The most common form of overpopulation involves not too many people for available space, but too many people for available resources, or too many people for the proper functioning of society.

f) Environmental Contamination: Increasing human population, rising levels of consumption, and the resultant demands for greater industrial and agricultural productivity inevitably result in increasing environmental contamination. Man must add the concept of recycling for our spaceship system, for the residuals of production not only pollute the system, but contribute to the depletion of valuable resources.

g) Environmental Quality: Man must develop attitudes of concern for the quality of the environment, in terms of both physical and psychological effects, which will motivate him to participate in environmental problem-solving (such as environmental planning).

h) Environmental Decisions: If man is to live harmoniously with his fragile environment, he must rethink consumer and corporate behavioral patterns as well as governmental policies. New behavioral patterns and policies need to reflect an emerging ethic where man is a steward of his environment. The environmental decisions in each of these three areas would represent collective interests and should be based on long-term environmental benefits.

2. Affective - To assist the participants in developing a concern for the quality of the environment and a motivation to help resolve environmental problems.

   Some important affective components that the program should assist the participants in developing are:

   a) Interested in his environment and its relationship to society.

   b) Sensitive (total awareness) to his environment, both natural and manmade aspects of it.

   c) Sensitive to the dimension of quality of his environment and able to recognize environmental problems.

   d) Inclined to participate in coping with environmental problems.

3. Skill-Behavior - To assist the participants in developing critical thinking and action skills necessary for them to help prevent and solve environmental problems.

   Specifically, the program is designed to assist the participant in acquiring these important skills:

   a) One important skill is to think critically, i.e., to

1) Identify critical issues
2) Recognize underlying assumptions
3) Evaluate evidence or authority:

   - Recognize bias and emotional factors
   - Recognize stereotypes and cliches
   - Distinguish between verifiable and unverifiable data
   - Distinguish between the essential and incidental
   - Distinguish between the relevant and non-relevant
   - Determine whether facts support a generalization

4) Draw a warranted conclusion (From the American Council on Education, Berg, 1965).

b) A second important skill is that of problem-solving. Problem-solving procedure consists of the following phases:

   1) Defining the environmental problem or issue
   2) Becoming informed about the problem
   3) Stating the alternative solutions
   4) Developing a plan of action based on a chosen alternative(s)
   5) Implementing the plan of action

c) A third important skill is learning the art of valuing (see Harmin, et al.). Decision-making is always a matter of weighing alternatives and consequences, and this requires practice in recognizing the values behind the choices made. Being able to choose among options and their ultimate effects involves development and assertion of personal, not teacher-inculcated, values.

d) A fourth important skill for citizens to possess in solving environmental problems is the development of change strategy. Once the citizen has defined the issue,collected and evaluated relevant information and weighed alternatives, he should have political insight for instituting the solution he has chosen as best.

Implicit in these goals and sub-goals are two corollary goals for students. One is the building of positive self-images so that individuals feel they can accomplish change. Another is recognizing and learning to deal in the complexities of modern life: there are no simple answers for the tangle of ecological interdependencies of biophysical and social systems. These are best fostered in a classroom atmosphere where the teacher encourages a free exchange of ideas and feelings. With this teaching model the teacher learns with students and they explore together, as opposed to students memorizing pre-digested content of a lecture.

V. Establish the Operational Objectives of the Environmental Education Program

During the school calendar year it seems appropriate that the following might be accomplished:

1. The establishment of an expanded and formalized environmental education advisory committee;

2. The selection of at least three pilot schools (one elementary, one junior high, and one high school) within the school district in which to develop and integrate environmental education program;

3. Within each pilot school --
    a) the presentation of the general concepts, and curriculum strategy goals of environmental education;
    b) the establishment of a school site development committee which has mapped an overall and long-range plan, raised funds, and begun to implement the plan;
    c) the offering of in-service teacher education workshops;
    d) the establishment of one teacher who serves to coordinate the program at that school and acts as a building representative in the planning and administration of the total program;
    e) the experimentation on the part of pilot classrooms in each school with at least one environmental encounter.

4. The training of citizens to assist in the program;

5. The offering of a comprehensive in-service teacher education program through workshops and extension courses, to cover the areas of environmental inventory, encounter writing, and school site development;

6. The establishment of a full or part-time environmental education consultant paid by the school system to continue the development of the program;

7. The development of bibliographies, films, lists and other instructional materials, resource speaker lists, written materials, and field trip opportunities for school use in environmental education;

8. The encouragement and facilitation of coordinating educational efforts among the local and state environmental-interest organizations;

9. The development of instruments to evaluate the program's effects and effectiveness, both for individual classes and for the program's direction and goals as a whole.

VI. Establish the Strategy for Curriculum Development and Implementation

A. Review of literature

A recent review of the literature regarding theories of learning and instruction reveals the following points that should be considered in the formulation of any environmental education program.

... Behaviors which are reinforced are most likely to recur. It is important that desired behaviors be reinforced by the home, school, church, youth organizations, etc.

... The most effective effort is put forth by youth when they try tasks which fall in the "range of challenge" -- not too easy and not too hard -- where success seems likely, but not certain.

... Youth are more likely to throw themselves wholeheartedly into any project if they themselves have a meaningful role in the selection and planning of the enterprise.

... Reaction to excessive direction of the teacher is likely to be: apathetic conformity; defiance; escape from the whole affair.

... What is learned is most likely to be available for use if it is learned in a situation much like that in which it is to be used and immediately preceding the time when it is needed. Learning in youth -- then forgetting, and then relearning when need arises is not an efficient procedure.

... The learning process in school should involve dynamic methods of inquiry.

... Learning takes place through the active behavior of the student. It is what he does that he learns, not what the teacher does. The essential means of an education are the experiences provided, not the things to which the student is merely exposed.

... One of the keys to motivation is a sense of excitement about discovering for one's self, rather than having a generalization presented by a teacher and requiring a student to prove it.

... Attitudes may not be formed through a rational process by which facts are gathered and a reasonable conclusion drawn, but rather through the repeated exposure to ideas.

... Helping citizens to acquire technical knowledge alone regarding an environmental problem, may not increase their concern for the problem.

... Citizens are more likely to become involved in environmental issues if they are aware of how they can have some effect upon decision-making.

B. Curriculum organization

An important criticism of our public school systems is the lack of adequate articulation between the various divisions of the school organization. Instead of well-developed series of instructional units and activities commencing at the kindergarten levels and terminating at the 12th grade, many school systems present a series of units that have little relationship between what has previously been taught and what will be taught in future years. An environmental education program, then, should span the curriculum K-12, so environmental experiences can be presented at every grade level, thereby capitalizing on the cumulative effects of the program. The umbrella concept of "spaceship earth" could facilitate this span.

It is also important to plan an interrelated curriculum horizontally as well as vertically. Disciplines, such as science and social studies, should not be studied in isolation. An environmental education program should link subject areas that relate most closely to the environment, so that both the social and scientific knowledge important in understanding and solving environmental problems are properly developed. For example, "water pollution" is intertwined with economics, governmental policy, biology, and attitudes, and demands interdisciplinary investigation.

A curriculum program should also recognize individual differences. There is no sequence that will meet the needs of all groups of youth. Therefore, a curriculum program should be flexible in design so that material can be presented in different ways depending upon the background, needs, and aspirations of the students.

The curriculum should integrate and correlate the program with the existing curriculum in a manner that will enhance the instructional goals of the school system. To add a course or a new subject area just about the environment into an already tightly-packed school day would be unrealistic and limiting.

The focus of the environmental education program should be on the local environment, though not neglecting regional, national, and international environmental issues. It should stress attitudes, valuing, and problem-solving skills. These students will be the urban voters who will make an important impact on their environment by their actions.

The learner should play an active role in the learning process. The curriculum should be structured so that the learner can develop attitudes through experiences and personal thinking, not through the presentation of pre-digested conclusions.

And finally, the curriculum design should provide for comprehensive in-service teacher education programs which would be continually available to assist teachers in being effective with this curriculum.

C. A Curriculum methodology: Environmental Encounters

It is extremely important to establish the specific curriculum program only after the goals, objectives, and basic organization alternatives have been thought through. Without a clear statement of these, the program would become a series of unrelated experiences with no clear purpose.

1. Definition of Environmental Encounters

Environmental encounters are designed as an approach for teaching about environmental issues, and best seem to fulfill all the specified needs of an environmental education curriculum program. They are based upon current knowledge of human behavior and upon the goals and objectives outlined for this program. This approach can be adapted to any classroom, elementary or secondary, but is not an additional course or new subject area.

Briefly, an environmental encounter within any class means that students themselves identify the problem they find most critical to them at the time. It may be a lack of places to ride their bicycles, or complaints of overpriced food at an inner-city grocery store, or concerns over a condominium development. Then the students do not just listen to a lecture on the problem. They seek out the facts in the community, and then weigh alternative solutions. And the alternative they find the best, they support with action. Thus the enoounter encompasses real-life problems. It helps the student learn the skills to improve his environment. It teaches him how to be an effective citizen by real experience. The investigation requires a multi-disciplinary study if all sides of the problem are to be understood. This well-rounded approach can occur in an English class just as well as in a biology or history classroom.

It should be made clear, however, that some of the areas to be studied need not be problem-oriented. This is particularly true at the lower grade levels where there should be an attempt to bring out basic awarenesses and appreciation for the environment. An example might be the investigation of the school site by a first grade class to expose the children to certain basic ecological principles. The recognition and solving of relevant problems is appropriate for the early grades, however. But the "honing" of problem-solving skills is more appropriate for the later grades.

Environmental encounters force the student to come to grips with many of the variables affecting environmental matters. For example, when procuring data and selecting alternatives, the student must deal with the political process, economic forces, and the state of our technology. The student is judged on how well he can deal with situations which are real rather than simulations of reality (Willink, 1970).

2. Writing encounters.

Each encounter should contain a list of the outcomes that are desired. The outcomes should be expressed as behavioral objectives. They (behavioral objectives) provide direction for the learning process; greater focus on the learner -- what the learner does, and the opportunity to appraise (evaluate) the effectiveness of a particular learning experience. Behavioral objectives can be stated in the three domains (cognitive, affective, and action) of educational objectives.

In writing behavioral objectives, it is important that the following criteria be met: 1) identify the terminal behavior; 2) describe the situation in which the behavior is to be observed; and 3) establish the extent to which the student should exhibit the behavior (Montague and Butts, 1968).

A school system desiring to develop an environmental education program based on environmental encounters might desire to have at its disposal a series of model encounters relating to all grade levels and disciplines. The number need not be large (Utica Public School System, 1970); however, it is recommended that students play a major role in both selecting and modifying existing encounters and developing new ones.

An example of an environmental encounter recommended for a 6th grade class is as follows:

INVESTIGATING A POND COMMUNITY

"An Environmental Encounter for a 6th Grade Class"

Behavioral Objectives:

In the completion of a successful encounter, the student should be able to:

1. Draw an accurate map of the drainage area of the pond community.
2. Describe in writing four ways that the land in the drainage areas affects the pond community.
3. Draw two (2) food chains illustrating organisms observed in the pond community.
4. List (number) major problems affecting the pond community.
5. Describe in writing the major steps in solving one (1) of the problems noted in question 4.

Activity:

1. What is the bottom of the pond community like? How does the type of bottom affect the kinds of plants and animals found in the pond community?
2. As you look from the center of the pond community toward the shore, are there plants growing under water, on the surface, and out of the water? Why are plants important to the pond community?
3. Dip a small jar into the pond and note if there are small organisms (these are probably plankton organisms). Why is plankton important to the pond community? What would cause plankton to increase or decrease?
4. Make or obtain a dip net and sample around the edge of the pond community. How are the animals you have caught important to the pond community? Draw a food chain linking some of the plants and animals you have noted in and around the pond community.
5. On a map of your community color in the land area that drains toward the pond. How has the use of this land changed over the past 15 years? What changes are occurring at the present time? How does the use of this land affect the pond community?
6. Do both children and adults visit the pond community? What do people do when they visit the pond community?

7. Do you see any problems that are affecting the pond community? Who is responsible for creating the problems? What could your class do to help solve one of the problems noted above (define the problem, become informed about the problem, state alternative solutions, develop a plan of action, implement the plan)? Is your class motivated and concerned about one of the problems to the degree that they desire to work toward its solution?

An example of an environmental encounter recommended for a high school American Government class is as follows:

FLOOD PLAIN ZONING

"An Environmental Encounter for an American Government Class"

Behavioral Objectives:

In the completion of a successful encounter, the student would be able to:

1. Draw on a map of his community the flood plains (50-year flood line) of the (name) River from (location) to (location) and record accurately how each flood plain is developed.

2. Describe in writing the number of floods and flood damage that has occurred on the flood plains of the (name) River from (location) to (location) over the past 60 years (or over the time that records have been filed).

3. Describe in writing the major provisions in the laws of his state and community regarding flood plain zoning.

4. Identify the power structure (pressure groups, governmental committees, governmental policy makers) of his community regarding who influences and makes policy on flood plain development and zoning.

Activities:

1. Take a tour (or illustrate by slides) along the (name) River from (location) to (location) and note the following:
    a. Are there a series of flood plains?
    b. How are the flood plains developed?
    c. Are there homes or buildings on the flood plain? Are they flood-proofed?
    d. Are there provisions for protecting the flood plains from flooding?
    e. What trends regarding land development are occurring on the flood plains of your community?

2. Seek information from reliable sources regarding the flood plains of the (name) River from (location) to (location).
    a. Has flooding of the flood plains occurred during the past 60 years?
    b. List the years in which flooding has occurred.

c. About how much damage (dollars, lives, inconveniences) has occurred on the flood plains as a result of flooding over the past 60 years?
d. What does your state flood plain ordinance say? If none exists, is it considering such an ordinance?
e. What does your community flood plain ordinance say? If none exists, is it considering such an ordinance?
f. How is the undeveloped land on the flood plain zoned?
g. Are there any current proposals to utilize the undeveloped flood plains of your river recreational, residential, commercial, or industrial development?
h. What proposals seem wise or unwise in light of the hazards you have identified?

3. Draw on a map of your community the flood plains (50-year flood line) of the (name) River from (location) to (location) and record how each flood plain is developed.

4. Determine by interviews the points of view of land developers, community citizens, realtors, chamber of commerce officials, planning commission members, city council members, and students of class regarding the future development of the flood plains of the (name) River from (location) to (location).

5. Based on the information collected, have the class formulate alternative solutions to the development (or preservation) of the flood plains on the (name) River from (location) to (location).

6. Draw a chart of the power structure (pressure groups, governmental committees, governmental policy makers) of your community regarding who influences (underline the influencers) and makes policy (circle the policy-makers) on flood plain development and zoning.

7. If the solution advocated by the class members is different from the point of view held by the planning commission and policy makers of your community, then develop and implement a plan of action (presentation to the appropriate authority, develop a fact sheet, publicize your position, etc.).

Each environmental encounter should also provide data regarding sources of additional information relevant to the topic.

The environmental encounters could be placed on "punch cards" and filed in a box, accompanied by a long metal "needle. " The box could be placed in the library or office of every school in the system and available for student and teacher usage. The following is an example of a format of an environmental encounter "punch card":

Lower Elem. Middle Elem. Upper Elem. Jr. High Sr. High

Ecosystem

Land Usage

Population

Environmental

Contamination

Recycling

Transportation

Public Service

Recreation

Environmental Design

Investigating River Pollution

Behavioral Objectives - At the completion of a successful encounter, the student should be able to:

1. . .

2. . .

3. . .

Activity:

1. . .

2. . .

3. . .

4. . .

Sources of Information

1. Film
2. Experimental Kit
3. Overlays
4. Written Material
5. Human Resources, etc.

An environmental education program based upon the philosophy of "spaceship earth," with environmental encounters providing the means for the learner to understand this important philosophy, should produce an individual who is: 1) sensitive (total awareness) to his environment; 2) able to recognize environmental problems; 3) sophisticated in the utilization of problem-solving skills essential to the solution of emerging environmental problems; and 4) inclined to participate in coping with environmental problems. The learner would also have an understanding and should see the importance of integrating ecological, economic, social, technological, and political information when working toward the solution of environmental problems.

VII. Establish In-service Teacher Education Program.

To assist youth in acquiring a working knowledge of the "spaceship earth" philosophy and the attitudes and skills essential in helping to resolve environmental problems, it is imperative that a comprehensive in-service teacher education program be provided. The extent to which students can be tooled up to be aware, concerned, and active about environmental problems rests with the extent to which teachers are tooled up to teach.

The goal, then, of in-service teacher education opportunities is to provide teachers with resources, background, and possible methodologies for environmental education. The programs and workshops should involve all teachers at all grade levels and from all subject areas. In-service training should assist teachers in developing and utilizing environmental encounters, and in further integrating environmental education into existing curriculum. It should provide written materials, names of resource people, sample encounters, field trip sites, and instructional aids applicable to the program.

In-service opportunities will be of four main types: Administrator workshops, environmental inventories, environmental encounter writing workshops, and school site development workshops.

In-service teacher education is often offered through several universities found in Michigan. Check with the extension services of these universities to see if they have such service with regard to environmental education.

The other three types of opportunities will be in the form of short in-service workshops within schools. They will be offered upon request to any school or school system, but the pilot schools will receive top priority for workshops. Again, these will be orientations to the basic tenets of environmental education, field trips into the community, development of written materials when possible, assistance in school site development and helps in integrating environmental education into existing curriculum. The Environmental Education Coordinator will serve to generate ideas and provide resources and suggest strategy for the various kinds of workshops conducted by her (him).

Still another opportunity to be explored is that of the Inter-Institutional workshop. This is a new possibility starting this year. The faculty of a school defines their most critical school problem, and explores the causes and solutions with a team of experts from four universities: Central Michigan University, Western Michigan University, University of Michigan, and Michigan State University. Credit will be given to this faculty group who are in turn committed to working towards solutions in their school.

VIII. Assist Schools in Developing their School Sites

Integral to environmental education curriculum and environmental encounters is the need for places to study and apply those principles. The development of a school site offers such a resource. It means actually designing and creating a richer environment -- aesthetically, educationally, and recreationally.

Traditionally, school buildings have been expensively equipped, highly educational facilities, while the sites outdoors have been made remarkably unstimulating environments. The grounds have been leveled and drained, and the vegetation removed. When youth are instrumental in the planning and fund-raising and construction of improvements on such a site, either new or already in use, environmental education is maximized. While they are providing new opportunities for curriculum enrichment outside of the classroom, they are building pride and unity into the student body, and learning about community resources and environmental design.

The procedural steps which can facilitate thorough site development are: 1) Form a school site development committee; 2) Consider guidelines for site selection; 3) Inventory the site (or possible future sites); 4) Recommend site to board; 5) Develop land use plan, land development plan, and land maintenance plan; 6) Develop phase-by-phase implementation plan; and 7) Develop a school and community utilization plan to include curriculum enrichment, in-service teacher training, and community use. Procedures for developing an existing site should include steps 1, 3, 5, 6, and 7.

IX. Develop Instruments to Evaluate the Effectiveness of the Program

Evaluative instruments will need to be developed to measure the extent to which behavioral objectives are attained and the effectiveness of the total environmental education program.

Evaluation will be of various types. One necessary kind is the immediate and continual feedback from teachers and students through verbal comments and observations. Another kind is the pre-and post-written test method. These should be objective, reliable, and valid. They could be applied to junior and senior high students, and perhaps to late elementary ones. Behavioral objectives outlines in encounters provide an excellent opportunity to appraise the effectiveness of particular learning experiences. Still another kind could be the story method. When a problem-situation story is told, the evaluator could measure the extent to which students are able to identify key issues, recognize environmental problems and recognize possible alternative solutions based upon ecological and social awareness.

In evaluating an environmental education program the following components should be examined: environmental awareness (environmental mapping), cognitive domain, affective domain, skill-behavior, exploratory behavior, self-concept, and teacher-student interaction.

SUMMARY

This pamphlet has proposed a strategy for the establishment of an environmental education program, K-12. It can be integrated into the existing curriculum of any school system by means of the environmental encounter and school site development approach.

Its goal is to help students become more environmentally educated decision-makers. The environmentally educated person should be knowledgeable concerning the bio-physical environment and associated problems, aware of how, and skilled in helping, to solve these problems, and motivated to work toward their solution. His education has helped him develop his attitudes and skills to be effective in environmental decision-making. With this program, the 12th grader may be exposed to all aspects of the environment. However, through the inductive (inquiry) approach advocated by this system, a 12th grader that had been exposed to this program should be more sensitive to his environment, better able to recognize environmental problems, more sophisticated in the utilization of problem-solving skills essential to the solution of emerging environmental problems, and more inclined to participate in coping with those problems, than the product of other forms of traditional instruction. The learner would also see the importance of relating ecological, economic, social, technological, and political information when working toward the solution of environmental problems.

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DEVELOPING AN ENVIRONMENTAL EDUCATION ACTION PLAN
U. S. Forest Service, Portland, Oregon

If man is to develop an increased understanding about his relationship to his environment and how to take positive action for its improved management, then it is important to plan for a series of logical and comprehensive environmental learning opportunities that relate to his needs and the needs of society and the environment. These learning opportunities should be a part of an overall environmental education plan. Some of the component parts of an environmental education plan are embodied in the following action planning sheets.

Environmental education action should reflect the adult education community as well as school children.

Listed below, for your information, are objectives from the proposed plan for environmental education -- State of Oregon.

PROGRAM AND CURRICULUM DEVELOPMENT AND COMMUNITY EDUCATION

Objectives: To improve the learning of basic skills (reading, writing, arithmetic) by providing experiences that allow for application of those skills in the total environment.

Application of these skills in a problem-solving approach to the environment will give children the motivation and competency to develop personal and group responsibility toward their social and natural environment.

Objectives: Provide environmental courses that involve the community public in activities resulting in an increased understanding of the environment, man's relationship and responsibility to the environment, and a motivation to participate in environmental problem solving, especially at the local level.

Provide opportunities in career development for students interested in environmental occupational training.

TEACHER TRAINING

Objectives: To improve teacher education by giving the teacher the tools to become highly skilled in involving students in the total learning environment. The application of these tools will develop interactions between a student and his environment that can lead to the development of his responsibility toward his society and environment.

EDUCATIONAL FACILITIES

Objectives: To identify and develop a network of educational facilties necessary to implement and improve a total quality educational experience for all students (K to adults including lay people).

PUBLIC UNDERSTANDING AND SUPPORT

Objectives: Close the communication gap by gaining acceptance and support on a local level of existing and new school district environmental education programs.

Close the communication gap by gaining acceptance and support on a state level of a state environmental education plan.

The following materials are designed, with samples and reference materials behind each Action Planning Sheet, to assist in the development of your Environmental Education Plan. Notice that behind each planning sheet are materials to assist you in the development of your Environmental Education Plan.

These materials are not designed to be all inclusive, but only to provide you with some reference information.

Materials include:

Inventory Sheet
Action Planning for Establishing a Local Environmental Education Committee
    Reference: Conservation Education Councils
Action Planning for Establishing an Environmental Study Area Plan
    Reference: Environmental Study Area Plan
        Schoolyard Development and Inventory Sheet
        Sample Worksheet for Interpretive Study Areas
        Sample Writings for an Interpretive Stop
        Sample Format for an E.S.A. Plan
Action Planning for a Teacher Workshop
    Reference: Samples of Workshops
        Two-weekend
        Evenings and Saturdays
        One-day
Action Planning for Constructing and Investigating an Environmental Education Curriculum into the Existing Educational System
    Reference: Some E.E. Curriculum Ideas and Guidelines
        Sample Environmental Investigation Assignment
        Sample Format E.E. Curriculum Exercise
        Some Guidelines for Developing Objectives of Performance Tasks
        Curriculum Development Cuestions
Action Planning for Putting the Component Parts of the Plan Together

DEVELOPING AN ENVIRONMENTAL EDUCATION ACTION PLAN FOR YOUR AREA

Inventory:

Do you have an Environmental Education Committee or equivalent in your community? Does it include a cross section of community people?

List the existing environmental programs in your area.

Do they range from Kindergarten to adult education?

What voids are there?

List the environmental areas used as classrooms.

List the additional ones that could be used.

What environmental education teacher and resource people workshops have been held in your area in the past 2 years?

What type of environmental awareness workshops have been conducted or are being conducted or being planned for community people in your area?

ACTION PLANNING FOR ESTABLISHING A LOCAL ENVIRONMENTAL EDUCATION COMMITTEE

List the steps involved in setting up an environmental education committee in your local area.

Community (or area or regional) Needs in EE.	How the EE Committee Could Meet That Need.

Identify key people and groups to be included in EE Committee.

People and Groups to be Included on EE Committee	Reasons for Their Being Included

Projects the committee might do to help needs:

Short-term projects:

Long-term projects:

(Select 1 or 2 projects from the above list that the EE Committee could initiate and complete in one year.)

Projects:

Steps to Implement the Project	Target Dates

SAMPLE CHART

Functions of the EE Committee

People or Groups Who Might Help EE Committee	Identify Local ESA for School Use	Teacher In-Service	Provide Forum for Sharing EE Concerns	Disseminate Info on Local Current Envir. Problems	Assemble Current EE Material for School Library	Etc.
Park & Rec. Department		Site				
School Dist. Superintendent		Support				
Turned-on Teacher		Help, plan & instruct				
News Media		Publicize				
Federal Agency		Provide resource people and/ or site				
Local Planning Commission		Provide maps, charts Infor. on studies				
Civic Organization		Provide steak bbq				

Construct a chart similar to the sample above. Put in your own column headings for:

a. People or Groups Who Might Help EE Committee
b. Functions of the EE Committee

This chart can be a planning tool for initiating and implementing various functions of the EE Committee.

A CHECK LIST OF IDEAS FOR AN ENVIRONMENTAL EDUCATION COMM

(Compiled for Teacher Comments)

Provide foundation for carrying out an environmental education program in an area .

Purpose of council

- a: Provide environmental training for educators and other interest groups (B.S.A. leaders, church groups).
- b. Selling groups for environmental education.
- c. Guidance and advisory group.
- d. Locate technical assistance for carrying out an environmental education program.
- e. Contact point for state and regional groups in environmental education.

People on council

- a. Group structure
  - 1. Figureheads - provide influence and stature to the group (mayors, state reps.)
  - 2. Technical resource people (local, state, and federal resource agencies).
  - 3. Concerned people who don't have the knowledge of environmental education, but have driving force for action.
  - 4. Key educators and administrators, principals, school boards, teachers.
- b. Make up by size of area
  - 1. Large towns - target group -- focus on educators and board of education because of large number of people.
  - 2. Small towns -- can cover all the towns, interests and types of people.

Jobs of council

- a. Set up a training team of resource and environmental educators.
- b. Establish workshops for educators and other interest groups.
- c. Set up environmental study areas.
- d. Guidance for school programs.
- e. Clearing house for assistance to educators (provide information on whom to contact or directly supply the technical assistance).
- f. Inventory what other groups are doing in environmental education, and try to provide central direction.

ENVIRONMENTAL EDUCATION COUNCILS

Many people including educators and natural resource managers are concerned by the lack of learning experience in school that will help a child observe and relate to his total environment. These types of experiences are imperative in developing an intelligent society capable of properly managing our environment. Many teachers are interested but do not have the skills or experience to provide conservation and outdoor learning experiences for students. Resource people can assist educators in developing facilities, activities, and curriculum for these programs.

Environmental education councils have been successful in planning and implementing programs in many areas. You may already have a committee or council that is concerned with some aspect of an environmental education program such as the county conservation day committee. It may be a simple matter to enlarge the committee's membership to include more educators and resource people and to broaden the existing committees objectives and program. Objectives of such a council are usually concerned with the implementation and coordination of environmental education programs with the existing school program.

WHO SHOULD BE ON THE COUNCIL?

The council should consist of educators and resource people who can exchange ideas and activities to enhance the development of quality school programs. Members should include, but not be restricted to, county school superintendents, school district superintendents, building principals, curriculum directors, classroom teachers, county extension agents, resource agency and private organization representatives, civic group representatives, park and recreation district representatives, college people, news media, etc.

WHAT CAN THE COUNCILS DO?

1. Teacher workshops.
2. Help plan and develop on-site schoolyard classrooms and activities.
3. Build self-guided nature trails.
4. Develop conservation teaching aids and activity sheets.
5. Provide coordination and dissemination of teacher requests in environmental education programs.

SOME STEPS IN ORGANIZING A LOCAL COUNCIL:

1. Invite a few key interested educators and resource people to a meeting to explore the possibility of establishing a local environmental education council.

2. If the group agrees to the need for a council, then set up a planning subcommittee to decide on whom to invite to the organization meeting, develop the program agenda, time and place. (Invitees should be those people that the planning committee identifies as action-type people who will get job assignments done.)

   The program might include some knowledgeable speaker who has had experience and can orient the group to the environmental education job in the schools and identify specific action jobs the committee can do to be effective. Don't get tied up in a lot of philosophy.

3. Hold meeting and have discussion on the needs and concerns in environmental education. (Have recorder take down pertinent ideas, existing programs, examples of programs elsewhere, new programs needed, contributions of manpower, materials, etc., offered, etc.)

   Appoint temporary chairman and secretary. Chairman should appoint an ad hoc committee to digest the meetings discussion and formulate a short report for the next meeting giving action recommendations for the direction of the group. Recommendations should be specific and relevant.

4. Have second meeting 1 month later to discuss recommendations, (mail out ahead of time) changes or additions. Adopt committee charter and subcommittee assignments. (Every person of the council should be assigned to a subcommittee or given some task.) Decide upon the first project the committee wants to undertake. It should be short, easy to plan, outside and assured of success. Examples are: one-day teachers' workshop on a school yard or along a nature trail; taking school administrators and school board members on a resource management show-me trip; helping a principal plan an outdoor laboratory on a school yard, etc.

5. Continue monthly meetings or regular meetings as needed.

6. Hold first project, have news coverage.

7. Continue to work with the educational community in as many ways as possible to enhance the educational experience in the schools.

8. Plan on having at least one or two activities involving the public schools each year.

EXAMPLES OF EXISTING COUNCILS:

1. King County Environmental Education Council, Seattle, ...
2. Kittitas Conservation and Outdoor Education Council, Ellensburg, WA.
3. Chelan-Douglas County Conservation and Outdoor Education Council, Wenatchee, WA.
4. Snohomish County Environmental Education Council, Everett, WA.
5. Pierce County Conservation and Outdoor Education Council, Puyallup, WA.
6. Clark County Environmental Education Council, Vancouver, WA.
7. Metropolitan Outdoor Education Council, Portland, OR.
8. Lane County Conservation and Outdoor Education Council, Eugene, OR.
9. Jackson County Conservation and Outdoor Education Council, Medford, OR.

Contacts for these councils can be made through the following:
David Kennedy, Environmental Education Consultant, Supt. of Public Instruction's Office, Olympia, WA.
Bus Vance, Environmental Education Consultant, Oregon Board of Education, Salem, OR.

One of the most beneficial programs the council can do is conduct teacher inservice workshops.

SOME PROGRAM ACTIVITY SUGGESTIONS

1. Sample One-day Conservation Workshop for Teachers

An important objective of a one-day teachers workshop is to involve the teacher in doing activities outside on the school yard, nature trail, in the forest, etc. The workshop can be held on Saturdays, professional teaching days, preschool orientation week, etc. The subject areas can be manned by resource people, and must not be lectures but group activity-oriented sessions.

8:15 a.m. Leave assembly point by bus for workshop area.
9:00 a.m. Arrive at area and assemble for orientation to field study.
Coffee break.

Each group of about 20 teachers will rotate through three different resource subject areas. If more than 60 teachers total, then have two soil groups, two plant groups, etc.

	Subgroup I (20 teachers)	Subgroup II (20 teachers)	Subgroup III (20 teachers)
9:30 - 11:00	Soils	Plants	Wildlife
11:00 - 12:30	Plants	Wildlife	Soils
12:30 - 1:30	Lunch		
1:30 - 3:00	Wildlife	Soils	Plants
3:00 - 3:30	Written evaluation		
3:30	Leave by bus for Roseburg		
4:00	Arrive Roseburg		

Each resource group will participate in "doing" activities to better understand the resources and their interrelationships on the area.

For example: Soil - Make micromonolith, feel and see soil structure and texture, observe soil-plant relationships, etc.

Plants - Use increment borers, tree identification, plant competition, determine tree volume, take range transects, plant-soil-animal relationships.

Wildlife - Find evidence of wildlife, discuss and construct wildlife habitat, discuss and observe animal-soil water relationships.

Other - Other subject areas can include: Water, creative arts, Language arts, survival, range utilization, etc.

2. Developing School Yard Classrooms

Many school yards can be improved to become a relevant outdoor classroom. Here are a few items that can be done:

a. Develop a soils pit

A soil pit large enough for several students to get into and conduct studies of soil horizon depth, texture, structure, PH, root penetration. There should be such a pit for each different type of soil in the area. Should be fenced so students can't fall in, consider a roof over the pit. Studies in characteristics of soil productivity, soil development, geography, economics.

b. Develop an arboretum of native plants.

An area planted to the native plants, trees, shrubs, ground cover plants, ferns, mosses, fungus, lichens. This is a long term project. The sun-loving plants are planted first and as ground shade is produced, shade-loving plants such as ferns, etc., can be added. Studies in plant succession, observational skills, classification, aesthetics.

c. Develop habitat for small game

Areas along the fence rows, odd corners and even some landscape areas around buildings can be planted to multiflora rose, bitter cherry, mountain ash, indian plum Cascara, etc., and will provide aesthetic screening from neighboring houses, protection for birds and small mammals. Studies in animal habits, feeding migration, classification, aesthetics.

d. Develop landscaping around school buildings

Provides aesthetic appearance, benefit and credit to community. Beautify the school grounds and blending of buildings to fit the school yard. To reduce classroom glare and solar heat problem, thereby increasing effectiveness of classroom learning environment. Enlarge study of plants and new animal habitats.

Should be accomplished as a part of the overall learning environment plan for entire school property at time school is built. Many native and introduced plants lend themselves to low cost maintenance and maximum aesthetic educational values.

Studies in aesthetics and beauty of our school, classification and study of new plants difference and reason for soil temperature in culturalized flower beds and compacted turf areas.

Difference in ornamental plants from native plants. Difference in wildlife found here from other areas. Shade as a factor in temperature change.

3. Nature Trails with self-guided booklet

Nature trails are developed in areas that have some natural resource features that can be interpreted and discussed with students. These are outdoor museums where the student observes, makes inferences about what he sees and then can discuss it with his class. The tour booklet helps the teacher prepare for the experience by giving her background information and by listing some questions that she can use as an interest starter for the lesson. The Audubon Society, Park Service, and U. S. Forest Service have several publications available as references in the development of nature trails.

4. Conservation Teaching Aids and Activity Sheets

Many times the teacher is at a loss for ideas and activities to use in the outdoors. The council members could develop simple experiment sheets on subjects such as inventorying range readiness, determining volume of tree, making soil analysis, identification of aquatic insects, or rules of thought about soil-plant relationships.

Teaching aids can be activity oriented. They should be designed to provide the teacher with student involvement in observation, measurement, classification, inferring and setting up simple experiments in the outdoors.

EXAMPLE OF ONE SET OF OPERATING GUIDELINES

1. This council will be known as the "King County Environmental Education Council."

2. Council Objectives:

   A. To provide for the wise use of natural resources through environmental education programs.

   B. To provide a forum where educators, resource managers, and other interested citizens can share concerns and information in the area of resource use education and seek cooperative solutions to their common problems.

   C. To provide environmental educational experiences for our county's youth.

   D. To coordinate requests from schools for resource people to assist with field trips, conservation projects, development of school sites and similar educational ventures.

   E. To foster training for teachers in environmental education through local in-service programs, teacher workshops, and educational television.

   F. To assist schools in integrating environmental education into their curricula -- publicacations, bibliographies, scope and sequence charts, and other conservation teaching aids.

   G. To act as a liaison with other environmental education committees, the Natural Resources Forum of Washington, Conservation Education Association, and other groups dedicated to furthering the wise use of our natural resources.

3. The council will be composed of interested representatives and/or individuals from citizen groups, education, industry, government and others who support the objectives of the council.

4. The council will meet monthly. Special meetings may be held as needed.

5. Council officers will be chairman, vice-chairman and secretary-treasurer. They will be elected by majority vote at the Spring meeting and serve one year. Officers will rotate: when the chairman completes his term, he will be replaced by the vice-chairman, and the secretary-treasurer will become the vice-chairman. Thus the secretary-treasurer will usually be the only new member each year.

6. Each member of the council will be appointed to a subcommittee.

7. These by-laws may be amended by majority vote of those members present at any regular meetings.

8. An executive council, comprised of the chairman, vice-chairman, secretary treasurer and immediate past chairman, is empowered to carry on routine council business between regular meetings of the full King County Environmental Education Council.

SUGGESTED SUB-COMMITTEES AND JOBS FOR COUNCIL TO IMPLEMENT

I. Outdoor Classroom Sub-Committee:

   A. Review by-law objectives C and D and suggest tangible ways in which they may be implemented.

   B. Assist schools with evaluation and development of potential outdoor classrooms. These include school yards, parks, natural areas, etc.

   C. List major problem areas we should consider for next year.

II. **Teacher Training Sub-Committee:**

   A. Review by-law objective E and develop and coordinate one-day environmental education teacher workshops.

   B. Disseminate information on conservation workshops and scholarships to teachers.

   C. Explore role of educational television in teacher training.

III. Curriculum Integration Sub-Committee:

   A. Evaluate major problems in environmental curriculum planning.

   B. Plan how by-law Objective F can best be accomplished.

   C. Work out method of placing conservation education material currently available in school libraries within area.

IV. Educational Tours Sub-Committee:

   A. Review by-law objectives C and D, and suggest ways in which educational tours offered by various private and governmental organizations can help achieve these objectives.

   B. Make listing of existing tours available to schools. Suggest how this listing may be best distributed to school administrators.

V. Extension Sub-Committee:

   A. Suggest ways of implementing by-law objective G.

VI. Coordination of Requests

   A. Review by-law D and explore ways of coordinating school requests for environmental materials and resource people.

ACTION PLANNING FOR ESTABLISHING AN ENVIRONMENTAL STUDY AREA PLAN

1. What function does an environmental study area serve?

2. a. List the possible steps that might be involved in initiating an environmental study area project in your area:
   b. Number the steps in the sequence they might be done.

3. Name the people or groups who might help in the inventory and use of Environmental Study Areas:

4. Develop a matrix showing jobs to be done and people to do them. Use information from #2 and #3 above.

Steps and target dates in initating an ESA project, from #2 above.

People or groups who might help in inventory and use of ESA from #3 above.

A CHECK LIST OF IDEAS FOR ENVIRONMENTAL STUDY AREAS
(compiled from teacher comments)

Identify need for environmental study areas.

Environmental Education Council should include a committee (team) for E.S.A. to identify, select and inventory each site and determine guidelines for its use and management.

Goals

Determine individual commitments by members of our committee and our group -- establish a committee.
Involve total community -- missing as few people as possible.
Education formally will be a sub-action of the community committee.
Get action to replace words -- a timetable.
Identify individuals interested -- agencies and committees already involved, establish committee.
Involve resource people, civic organizations, informal and formal groups, interested groups, clubs.
School -- representative appointed by superintendent.
Meet -- for action.
Encourage active participation and community leadership.
Develop criteria for priorities of land selection.
What ecosystems do we want to study?
Look for an area or areas that represent several ecosystems and environmental situations.
Compare natural to man-made.

Inventory Jobs

Who
Divide the job of inventory
a. Natural areas
b. Urban
c. Rural
How - field investigation

Reports or record
a. Map
b. Photogrammetry
c. Photos
d. List of what is on area (narrative)
e. Distance from school

Selection

Prepare a plan of development and show how to best use the selected areas.
Which of the inventoried will we use and promote?
Prepare a summary of areas with our recommendation.
Availability of land.

Development

Secure approval for (ownership?) use from appropriate agencies and individuals.
Inventory existing physical features.
Determine desirable additions -- development priorities, including: Timeline and master plan, safety, access to and through et al.
Implement and coordinate: a. Work forces, b. Finances, c. Public relations, community involvement.
Develop in-service program for interested teachers, etc. (require it before use of E.S.A.'s)

Promotion of area

Meet with local press, community leader and groups.
Initiator -- stir interest -- locate other interested parties.
Gather interested people for local site committees.
Set some objectives based on local needs. Committee would develop selling approach to proper officials.
a. Promote inventory of potential sites
b. Promote use of sites

ENVIRONMENTAL STUDY AREA PLAN

The educational process must encompass a wide variety of learning environments in order to equip our young people with the educational tools necessary for intelligent and effective environmental management.

There are many opportunities outside the classroom that provide students with a variety of environmentally oriented experiences.

Teachers and administrators must be able to identify and use these "outside-the-classroom" environments to complement the existing school curriculum.

One term applied to these learning environments is environmental study areas (E.S.A.). These areas can be used for the application of basic learning skills through collecting and interpreting data, identifying environmental problems, exploring cause-and-effect relationships, and developing alternative solutions to environmental management.

An environmental study area is a place, then, where a person can become involved in investigating some aspect of man's relationship to his environment (natural or man-made). It can range from a near natural area to the man-altered areas of urban renewal.

Steps to initiate an environmental study area project in your school district might include:

Inventory the environmental study areas of community (natural, man-made, man-altered, etc.).

Inventory professions and avocations that can contribute to improving the interaction between students and their community environment.

Develop a broad curriculum spectrum to visually show how the school site, local E.S.A., professions, avocations, etc., fit into the educational objectives.

Hold a series of environmental-awareness workshops and meetings for the public, teachers, students, etc., to unveil and discuss the proposed total community environmental education project.

Establish a series of lay committees (students, teachers, community people) to develop learning packages to fit the environment, needs of kids, teachers, and educational objectives.

Parts of the project include in-service training courses for teachers to develop additional skills in the use of E.S.A.'s (such as setting up problem solving situations, data collecting experiences, etc.).

SCHOOLYARD DEVELOPMENT

The school can be used to apply skills learned in the classroom as well as develop a concept or understanding about some relationship that exists in the ecosystem.

Here are some items to consider in the development of school yard E.S.A.:
Establish a school site committee (students, teacher, and community, Extension, S.C.S., parents, etc.).
Construct a map of the school site.
Identify and describe unique characteristics.
Develop a plan of use and alternative use.
Develop a brochure about the school lab.
List plants and plot on map.
Investigate possible sources of plants.
Develop a priority planting plan.
Plant first round of plants.
Establish records and keep procedures.
One-day in-service workshop on use of school yard as a learning environment.
(Involve students, teachers, parents.)
Write-up school yard environmental investigations (involve students).
Water and maintain plants -- summertime.
Plant second round of plants.
Second in-service workshop.
continue: 1. Development of school yard.
2. Training sessions (students-teachers).
3. Curriculum development.

Each teacher can involve her class in the inventory of their school yard and itemize how they can use it in their teaching situation.

Here are some examples of items to be considered for development for use by students, teachers, PTA, community, etc.

1. Arboretum of Plants

   a. Description: An area planted to native plants, trees, shrubs, ground cover plants, ferns, mosses, fungus, lichens. This is a long-term project. The sunloving plants are planted first and as ground shade is produced, shade-loving plants such as ferns can be added.

   b. Possible learning situations: Classification, identification, economics of plants, growth requirements, observational skills, art texture, aesthetics of plants, seasonal changes of plants and animals, studies in plant succession.

   c. Location: Corner of school yard, area not in mainstream of play yard.

2. Soils Pit

   a. Description: A soil pit or bank large enough for several students to get into and conduct studies of soil horizon depth, texture, structure, pH, root penetration. There should be such a pit for each different type of soil in the area. Should be fenced so students can't fall in; consider a roof on the pit for winter use.

   b. Possible learning situation: Soil studies related to plant growth requirements, water percolation, what is soil, land capability uses, soil erosion, hazard studies, process of soil making, art assignment of painting texture.

   c. Location: Corner of school yard or nearby vacant lot, etc., where good soil profile can be studied safely.

3. Wildlife Habitats

   a. Description: Areas along the fence rows, odd corner and even some landscape areas around buildings to be planted to multiflora rose, bitter cherry, mountain ash, india plum, cascara, etc. Will provide aesthetic screening from neighboring houses, protection for birds and color to the school yard.

   b. Possible Learning Situation: Classification, identification of wildlife, wildlife habitat, comparison to other habitat, requirements for survival, wildlife found in area, social and economic values of wildlife, an area of social structure with species of wildlife, physical adaptation of wildlife to this environment (do all kinds have same type of bill? Why don't squirrels have canine teeth, etc.?)

   c. Location: Along fence row, odd corners in school yard, flower beds, etc.

4. Outdoor Classroom Gathering Place

   a. Description: For class to gather informally to study anything. A secluded spot, sheltered from wind and people. Might be a depression in the ground, an amphitheater type. Might have benches, logs, or just grass.

   b. Possible learning situation: The class does not have to stay in the four walls of a classroom to study from a text, do a language arts assignment or have a debate. Can be used to enhance writing a Haiku, read a poem, discuss a current problem or do a class assignment.

5. Picnic Area

   a. Description: Area under shade trees on or near lawn, or mowed grass area with enough tables so a whole class can enjoy a lunch. Fireplaces can be provided as needed or desired.

   b. Possible Learning Situation: Develop proper attitude for use of outdoor environment -- what to do with garbage, papers, etc., after eating, how to properly build and extinguish campfire and cleanup afterward, social experience of courtesy and sharing the outdoors together, values of recreation facilities, need for proper use of outdoor with more leisure time.

6. Outdoor Environment Laboratory Area

   a. Description: (1) An area of land that is in its natural state. This might be a wooded area, a vacant lot of native grass, and other plants, hardwood area, a bog, swamp, etc. The important thing is that it remains in its native state and that man doesn't tamper with the natural environment. This may be an area 1/2 to 20 acres or more. (2) An area near the school buildings for students to plant a garden of tree seedlings, flowers, or vegetables in conducting growing plant studies.

   b. Possible Learning Situation: Quadrant study of soil, plants, wildlife relationships, studies in plant succession, natural and social history studies of area, wildlife habitat, growth requirements of plants, aesthetics of natural areas.

7. Landscaping of School Grounds

   a. Description: Should be accomplished as a part of the overall learning environment plan for entire school property at time school is built. Many native and introduced plants lend themselves to low maintenance costs and maximum aesthetic educational values. Sycamore or sweet gum trees, for example, are fine to plant in front of south and west school room windows to provide shade for bright sunny days thereby cutting glare and heat inside and causing better learning situation.

      Provides aesthetic appearance, benefit and credit to community. Beautifies the school grounds and blends buildings to fit the school yard. To reduce classroom glare and solar heat problem, thereby increasing effectiveness of classroom learning environment.

   b. Possible Learning Situation: Aesthetics and beauty of our school environment, classification and study of new plants, difference and reason for soil temperature in culturalized flower beds and compacted turf areas. Difference in ornamental plants from native plants. Difference in wildlife found here from other areas. Shade as a factor in temperature change.

   c. Location: Entire school grounds.

SAMPLE INVENTORY SHEET TO USE WITH YOUR CLASS IN INVENTORYING YOUR SCHOOL YARD

Part 1. List the different areas on your school yard that can lend themselves in providing meaningful learning activities for your students. You can list your areas by location, different plant communities, habitats, etc.

Area	Activities

Part 2. List the specific things you would add to your school yard to improve its use as an outdoor classroom (plant wildlife, food, plants, develop arboretum, etc.)

Area	Activities

Part 3. Make a sketch or drawing of your school yard showing the location of items in No. 1 and where you would put items listed in No. 2.

(Develop land use zoning and planning guidelines for school yard and delineate uses on school yard sketch map.)

SAMPLE WORKSHEET FOR INTERPRETATIVE STUDY AREA

Area or Station No.	Description of area or Station	Interpretation of Area or Station

SAMPLE WRITE-UP FOR AN INTERPRETIVE STOP

Grade level to be used: ____________________

Description of object: (Rotten log, crowded tree stand, evidence of wildlife, soil pit, etc.)

Interpretation of object: (Discuss the ecological and natural aspects of the subject.)

Discussion of subject with students through questions (List questions and investigation in sequence for developing the subject with students.)

List areas of curriculum where this activity would apply and give an example.

ACTION PLANNING FOR A TEACHER WORKSHOP

1. What skills or competencies do teachers in your area need in Environmental Education? Example: Skills in setting up open-ended environmental investigations with students, skills in using Environmental Study Areas. discussion skills in environmental issues.

2. Based on skills and competencies identified, construct a schedule showing what sessions will be conducted.

   Consider length of time,
   number of participants,
   who is available to construct,
   who you need to contact.

SAMPLES OF ENVIRONMENTAL EDUCATOR WORKSHOP

Objectives

(1) A sample teacher workshop.

As a result of this course, teachers should be able to:

1. Involve their students in environmental investigations using techniques of:
   a. Collecting, recording, interpreting and analyzing data.
   b. Formulating alternative solutions and action plans for environmental problems.
2. Identify areas on the school yard and other parts of the community that could be used as environmental study areas, and develop materials for their use.
3. Develop instructional materials that strengthen the relationship of existing education programs to environmental education.
4. Explain to key community leaders and group how environmental education helps accomplish the goals of quality education.

A TWO-WEEKEND FORMAT

Friday, March 17	
7:00 - 10:00 p.m.	Registration, orientation, philosophy, process, approach, classification and observation activities.
Saturday, March 18	(Teachers will be in three groups and rotate) Environmental field investigations
8 - 12:00 a.m.	Investigations for land use planning, measuring some water quality
1 - 5:00 p.m.	Criteria, interpreting the landscape
7 - 9:00 p.m.	A land use simulation game
Sunday, March 19	
8 - 12:00 a.m.	Investigations for land use planning, measuring some water quality
1 - 3:00 p.m.	Criteria, interpreting the landscape.
Friday, April 7	
7 - 10:00 p.m.	Planning for the urban investigation
Saturday, April 8	
8 - 3:00 p.m.	Urban investigations
3 - 5:00 p.m.	Comparing two environments
7 - 10:00 p.m.	Planning and development for selected environmental education programs (E.S.A.'s outdoor school, simulation)

Sunday, April 9 8 - 12:00 a.m.	Teachers will be divided into three groups and will select one topical area for the day: Observing environmental habitats, mapping the environment, and creative communications
1 - 2:00 p.m.	Environmental education and the total learning environment

SEVEN-EVENINGS AND TWO-SATURDAY WORKSHOP FORMAT

Wednesday, January 19 7:00 - 10:00 p.m.	Registration, problem solving process, classification and observation activities
Wednesday, January 26 7:00 - 10:00 p.m.	Land use simulation game
Wednesday, February 2 7:00 - 10:00 p.m.	Preparation for urban investigation
Saturday, February 5 8:00 - 3:00 p.m.	Urban investigation
Wednesday, February 9 7:00 - 10:00 p.m.	Development of environmental study areas, environmental investigation for primary, secondary, etc.
Saturday, February 12 8:00 - 3:00 p.m.	Investigations of a wetland environment at Ridgefield Refuge.
Wednesday, February 16 7:00 - 10:00 p.m.	Micro-environmental investigations
Wednesday, February 21 7:00 - 10:00 p.m.	Comparison of urban and forest environment
Wednesday, March 1 7:00 - 10:00 p.m.	Curriculum development in environmental investigations

A ONE-DAY "OUTDOOR LABORATORY" WORKSHOP FORMAT

9:00 a.m.	Arrive at area and assemble for orientation to field study. Gather into groups of about 20 each.
9:30 a.m.	Group study areas (Study areas would differ to fit the environment.)

TIME	I	II	III
9:30 - 11:00 a.m.	Soils	Plants	Wildlife
11:00 - 12:30 p.m.	Wildlife	Soils	Plants
12:30 - 1:30 p.m.	Lunch		
1:30 - 3:00 p.m.	Plants	Wildlife	Soils
3:00 - 4:00 p.m.	Evaluation		

1. Form discussion groups by grade level: 1-3, 4-6, 7-8, and 9-12. A discussion leader and recorder will be assigned in each group.
2. Brainstorm the topic "How can we integrate the use and study of this outdoor laboratory into our present classes?"

4:00 p.m. Dismissed

ACTION PLANNING FOR CONSTRUCTING AND INTEGRATING AN ENVIRONMENTAL EDUCATION CURRICULUM INTO THE EXISTING EDUCATIONAL SYSTEM

(Consider identifying objectives, environmental investigations that lead to student developed generalizations, self-oriented task cards, curriculum relationships, group problem solving skills, etc.)

SOME ENVIRONMENTAL EDUCATION CURRICULUM IDEAS AND GUIDELINES FOR ENVIRONMENTAL INVESTIGATIONS

Consider these items in developing and evaluating your environmental investigation. (See Guidelines for Collecting Data for Environmental Problem Solving.)

1. Does the activity actually involve the learner in the environment? (Consider the list of learning processes below.)
2. Is the activity relevant to the learner in his world?
3. Does the activity include opportunities for problem-solving?
4. Does the activity include opportunities for the learner to collect and record data based on his own observations?
5. Does the activity include opportunities for the learner to make his own interpretations about the data he collects?

Two areas for developing environmental investigations include:

Examples Investigating a Specific Problem

Develop detailed instructions for setting up a long-range environmental investigation about a specific topic or problem.

Effect of soil temperature on rate of plant growth on the school yard.

Correlation between observable weather conditions and local air pollution.

Year-long inventory of wildlife habitat preference on the school yard.

Comparison of Different Environments

Develop detailed instructions for setting up an investigation to compare different environments. (Specify whether the study involves the total environment, or whether only parts -- soil, water, etc., -- of that environment will be considered.)

Some examples are: Comparison of urban and rural environments
Comparison of terrestrial and aquatic environments
Comparison of school yard and city park environments
(See - A Lesson Plan for Comparing Two Environments)

The Lesson Plans in "Investigating Your Environment" Series - U.S. Forest Service have many tasks and investigations to assist in collecting and interpreting data.

SAMPLE OF ENVIRONMENTAL INVESTIGATION ASSIGNMENT FROM A TEACHER WORKSHOP ON ENVIRONMENTAL EDUCATION

A. Describe in writing a project to be used in your teaching situation to inventory, collect and interpret data about some part of the man-made environment in which you live.

1. List procedures in process terms. (See Lesson Plan for a Process Problem Solving Approach to Learning.)

2. Do not use the same content used this weekend. (Soil pit, stream, forest, or plants.)

B. Describe in writing the results of the investigation as done by your students.

Examples:

Correlation of observable weather conditions to air pollution index.
Correlation of man-made sounds to noise pollution.
Effect of signs and billboards on sight pollution.
Effect of architecture on aesthetics.
Impact of local shopping center on community.
Supermarket survey (packaging, buying habits).
Interpreting the man-made landscape using architectural styles, etc.

FORMAT FOR AN ENVIRONMENTAL EDUCATION CURRICULUM EXERCISE

ACTIVITY:

GENERALIZATION TO DEVELOP:

EQUIPMENT:

STEPS TO ACTIVITY: Put the lesson into 3 categories:

1. The Preparation
2. The Investigation (Data collecting & interpreting)
3. The Followup (Additional data collecting, further interpreting, application to environmental management, etc.)

PERFORMANCE TASKS: State in terms that describe what the learner will be DOING to demonstrate achievement of your objectives.

1.

2.

3.

CURRICULUM RELATIONSHIPS: State how any of these curriculum areas might be a part of your activity.

Social Science (geography, history, economics, sociology/anthropology, political science)

Science/Math

Language/Creative Arts

Other

ECOLOGICAL THEMES: Give at least two examples of how ecological concepts can be developed through the activity. Examples of some concepts are change, diversity, interrelationship, adaptation, etc.

SOME GUIDELINES FOR DEVELOPING OBJECTIVES OR PERFORMANCE TASKS

1. An objective describes an expected change in the learner's behavior.
2. When the learner has DEMONSTRATED this behavior, the objective has been achieved.
3. An objective is a group of words and symbols which communicate the expectation of the learner so exactly that the others can determine when the learner has achieved it.
4. A meaningful stated objective, then, is one that succeeds in communicating your expectation for the learner.
5. The best objective is the one that excludes the greatest number of possible alternatives to your goal. (No misinterpretation.)

ACTION WORDS

Here are nine action words from the American Association for the Advancement of Science that apply to curriculum related activities in the environment. These are not the only usable action words.

Identify - The individual selects a named or described object by pointing to it, touching it, or picking it up.

Name - The individual specifies what an object, event, or relationship is called.

Order - The individual arranges three or more objects or events in a sequence based on a stated property.

Describe - The individual states observable properties sufficient to identify an object, or relationship.

Distinguish - The individual selects an object or event from two or more which might be confused.

Construct - The individual makes a physical object, a drawing or a written or verbal statement (such as an inference, hypothesis, or a test of any of these.)

Demonstrate - The individual performs a sequence of operations necessary to carry out a procedure.

State a Rule - The individual communicates, verbally or in writing, a relationship or principle that could be used to solve a problem, or performs a task.

Apply a Rule - The individual derives an answer to a problem by using a stated relationship or principle.

(Notice Performance Tasks listed at the end of each Lesson Plan in Investigating your Environment Series.)

Consider these items in evaluating your performance tasks:

1. Have you described the behavior the learner will demonstrate as evidence that he has achieved the performance task?

   Is it a measurable action or performance by the learner? (See list of Action Words.)

2. **Have you stated the conditions you will impose upon the learner when he is demonstrating his mastery of the performance task?**

   Examples:

   using the length of his own step he will demonstrate_____________________________

   given a list of rocks he will distinguish____

   given a set of tree samples he will construct a dichotomous key____________________

   using a highway map of his state he will describe________________________________

ONE WAY TO SET UP YOUR OBJECTIVE:
INSTRUCTIONAL OBJECTIVE:

What will the learner be DOING?　　　　Write:

What CONDITIONS will be imposed?

How will success be RECOGNIZED?

The complete instructional objective should be written below.

CURRICULUM DEVELOPMENT QUESTIONS

These questions should be used and considered near the end of a course or after the actual environmental investigations and activities have been done.

1. What processes and methods did you use in your investigations?

2. What other methods and procedures could you have used?

3. If you had more time, what additional information could you collect in your area?

4. What are some "focus words" that could be used to study an area? (change, repetition, continuity, interdependence, etc.)

5. Describe one or two activities that you can do with your students to investigate some part of your community environment.

6. What part of our investigations, that we have done, can be directly replicated with audiences or students in your teaching situations?

ACTION PLANNING FOR PUTTING THE COMPONENT PARTS OF THE PLAN TOGETHER

(Review the parts of the plan -- E.E. Committee, E.S.A.'s, workshops, curriculum, and list the steps, meetings, target dates, projects, etc., needed to implement the plan. Identify individuals and/or groups best qualified to implement various parts of plan.)

INVESTIGATING YOUR ENVIRONMENT

U. S. Forest Service, Portland, Oregon

INTRODUCTION

The environmental investigations in this series are designed to help you take an in-depth look at different component parts of your environment. The investigations were developed after several years of field-testing with teachers, resource people, and students for use in environmental education training courses for teachers and resource people.

The lesson plans provide a structure to learning in that one activity builds on others and leads to some concluding environmental interactions. It also provides freedom within the structure for the student to observe, collect, and record meaningful information at his own pace through the use of the self-directed task cards. This changes the role of the teacher from that of a dispenser of facts and information to that of a facilitator, motivator, and learner along with the student.

You will notice that in most cases charts and tables are provided for the student to interpret his own information on data collected.

These lessons also provide for a maximum of student response and summary because of the discussion and questions sections.

The processes used in these lessons can be replicated and are transferable in any environment. (Collecting observable data, making inferences, setting up investigations to check out inferences, communicating feelings and awareness.)

The activities used are not replicable in all environments. You will have to develop activities appropriate to the environment in which you are investigating.

The authors of these lesson plans felt it was important to include the following elements:

Processes

The processes of both data collecting and group problem solving are the first step toward understanding important generalization and big ideas about the environment.

Self-Directed Task Cards

Self-directed task cards are used to accomplish certain activities without the aid of the instructor. Some could be removed from the rest of the lesson plan and used as isolated activities for shorter periods of time.

Discussion Questions

Discussion questions are used as introduction to activities or as summary follow-up to activities. (This minimizes instructor explanations and involves the participants in contributing their thoughts and information.)

Analyzing Charts and Tables

These are provided so student can interpret his own data collected and check out his inferences made during the investigations.

Summarizing Questions

The summary questions used at the end of certain tasks and at the end of the session are one of the most exciting and important parts of each lesson. These questions are designed to:

1. ALLOW PARTICIPANTS TO DISCUSS THE IMPLICATIONS OF WHAT THEY LEARNED TO THE MANAGEMENT OF THE ENVIRONMENT.
2. ALLOW PARTICIPANTS TO GENERATE THEIR OWN CONCEPTS AND GENERALIZATIONS ABOUT WHAT THEY HAVE DONE.

Behavioral Outcomes

The behavioral outcomes for each lesson indicate some minimal expectations in acquiring new knowledge and skills and indicate the nature of expected outcomes in feelings, awareness, values, and action about the environment.

IMPLEMENTING THE INVESTIGATIONS

The guidelines listed below are designed to help you involve people in environmental investigations. They are in no way "sure fire." You may have to change some of them to adapt to your situation and you may want to add to or delete from the list.

Make sure you have all your materials and equipment ready and that you have visited the necessary parts of the environment you will use in your investigations. Is there sufficient amount of equipment and is it all in working order? How are you going to check it out and make sure you get it all back (see guideline 4)?

Before you leave for the study area with your group have you discussed possible hazards with them and the "rules of the road?"

Some guidelines:

1. Go over quickly with your students what will take place during your session so they will know what to expect.

2. Use the lesson plan outline as a guide involving questioning strategies and self-directed investigations. Revise as necessary to fit your situation.

3. Minimize teacher talk and/or lecture (refer to and use question and discussion sections of outline - these work in eliciting responses).

4. Plan and pace your session so that what you do is done thoroughly and well. For example, it is okay to give them some data to solve a problem, instead of letting the class gather it, if time is a problem. Don't have your lesson so rushed that you have to give out data all the time. If you have a time restriction, make sure you decide ahead of time which Tasks you are going to eliminate.

5. The summarizing question and discussion area of how this relates to man and the management of the environment is so important that you should plan to start the summarizing and discussion area of the session at least 1/2 hour before dismissal.

6. Conclude the session with the summarizing questions or equivalent at the end of the lesson plan. (This is one of the most important parts of the activity.) This will give you an evaluation tool to see what generalizations or concepts students can generate.

7. Have class discuss and list in small groups ways in which the study activities can help change attitudes. Groups may share ideas.

8. Assign one or two students to be accountable for equipment at the beginning of each session. (Have the same people be responsible for cleaning up the equipment at the end of each session.)

9. Be thinking of ways your lesson can be integrated into the curriculum when you return to the classroom. What kind and how much follow up are you going to do?

10. When your session is finished, jot down strengths and weaknesses so you can revise your lesson so it will be better next time.

The authors also feel the ideas written here will suggest new ways of using your environment for learning, and that the activities and ideas will never really come to life until you have modified and changed them to fit your own needs. So if you use the lesson plans exactly as they are written here, you will be using them incorrectly.

As in any important learning experience, the instructor should go through the lesson plan and the environment in which the activity will take place before introducing it to the students.

LESSON PLAN OUTLINE FOR INVESTIGATING ENVIRONMENTAL HABITATS

U. S. Forest Service, Portland, Oregon

Set the stage for this investigation by reviewing quickly what will take place in the allotted time. For example: In the next 4 hours we will investigate several environmental habitats; infer how animals fit into food chains and energy cycle, and how they are important to the environment; record changes in habitats and discuss what we can do as citizens to improve the biological interactions in our environment. (You might want to read the behavioral objectives at end of lesson and refer back to them as an evaluation of session.)

I. OBSERVING AND MEASURING ANIMAL SIGHTING AND EVIDENCES

Questions and Discussion (10 minutes)

1. What animals would we expect to find living in this area? (vertebrate, invertebrate)
2. What are the needs of these animals?
3. What are some names of the place where animals live?
4. Where would you look for animals around here?
5. Describe and pass out Task A and B cards.

Task A: (30 minutes) Work in small groups.

1. Explore as many places (environments or habitats) as you can from _______________ to _______________, and record animals that you see or any evidence of animals. As you inventory the animals or their evidences, figure out some way of recording amounts of evidences and animals seen.
2. Look for and list evidence (signs) of animals (partly consumed foods, excrement, homes, bird nests, feather, etc.)
3. Observe and list different habitats for wildlife in area. (Grass, cultivated field, hedges, swamp, etc.)
4. Observe and list animal foods in area:

HABITAT INVENTORY AND COMPARISON

Task B: (30 minutes) Work in small groups. Select three different habitats and compare the numbers of animal organisms and the characteristics in each.

Habitat I	Habitat II	Habitat III
Characteristics of Habitat I	Characteristics of Habitat II	Characteristics of Habitat III

Questions and Discussion

1. What animals did you find in each habitat?

2. Which habitat had the most animals? Why?
3. What were the characteristics of each habitat?
4. What could account for the differences and similarities of the habitats?
5. What factors made one habitat more desirable than another?
6. Pass out Task C.

Task C: (15 minutes) Build a food pyramid showing the comparative amounts of animal and animal evidences seen.

Questions and Discussion (15 minutes)

1. What did you find?
2. How many habitats did you investigate?
3. Which animals around here have the largest habitat, the smallest?
4. What was the largest group of animals found?
5. What do you think their main function in the environment might be?

Discuss terminology and definitions of herbivores, carnivores, omnivores, decomposers.

Pass out Task D.

Task D: (10 minutes) List the animals you have seen or their evidences in the appropriate places in this diagram. Put in arrows. What other words and ways can you think of to illustrate a similar cycle?

Light

Plants
____
____
____
____

Nutrients

Herbivores (plant eaters)
____
____
____
____

Decomposers
(bacteria-fungus)
____
____
____
____

Death

Carnivores (meat eaters)
____
____
____
____

What would happen if one group were eliminated?

If __________ group was eliminated, I think the following would happen: __________

____

Questions and Discussion (5 minutes)

1. What is the function of each part of the energy cycle?
2. What would happen if the decomposers were removed from this ecosystem?
3. How does the energy cycle relate to a food chain?
4. What is a food chain? (Who eats whom?)

Pass out Task E.

Task E: (10 minutes) Construct a five-stage food chain using specific animals seen so far.

II. OBSERVING AND RECORDING CHANGES IN ANIMAL HABITATS

Questions and Discussion (10 minutes)

1. How did your food chain relate to the energy cycle in Task D?
2. What is difference between food chain and food web?
3. Look at your food chain and see if you can construct a web out of it.
4. What evidences of influences can you name that have affected this environment?

Pass out Task F.

Task F: (20 minutes) Describe in writing, three influences that you observed that have changed the habitats in this area, and the cause and effect relationships that occurred. Consider:

a. Evidence of change, influence that made it.
b. What area probably looked like before change occurred and animals that lived then.
c. What area looks like now and animals that live here.
d. How the change affected the habitat and animal species that did and do live there.

Questions and Discussion (10 minutes)

1. Have individuals read their descriptions, and compare different descriptions.
2. What evidences did you find that show man's influence in this area?

III. COMMUNICATING FEELINGS, AWARENESS, AND VALUES ABOUT THE ENVIRONMENT

Task G: (10 minutes) Describe how you feel about man's effect on one animal habitat you observed.

Questions and Discussion
1. Discuss results of #G with group.
2. What are some things that man has done to effect the efficiency of the energy cycle?

Task H: (15 minutes) Describe in writing three things you can do in your everyday life to make the energy flow more efficient and cause the least amount of harm to the ecosystem.

Select the one you think would be your best contribution. Describe the benefits of this action
a. Where you live --
b. In your consumer habits --

Discuss Results of Task H.

Summary Questions
1. What did we find out about animals in our field study session today?
2. Why are animals important in the ecosystem?
3. How can we summarize our investigations today?
4. What processes and methods did we use to find these things out?
5. Which of the behavioral outcomes did we accomplish in this session? (Read and discuss.)

Task I: Describe in writing how you feel about our session today.

BEHAVIORAL OUTCOMES IN KNOWLEDGE

Identify and describe six different animal habitats.

Construct a diagram of an energy cycle, using the evidences and sightings of animal life observed at the site.

Describe at least four cause-and-effect relationships of the role of the decomposers in the energy cycle.

BEHAVIORAL OUTCOMES IN FEELINGS, AWARENESS, VALUES, AND ACTION

Describe how you feel about man's effect on one animal habitat observed at the site.

Describe three things you can do in your everyday life to make the energy cycle more efficient, and cause the least amount of harm to the ecosystem where you live and in your consumer habitats.

This lesson plan was developed for use in teacher workshops by Pete Hinds, Milwaukie, Oregon; Ernie McDonald, Portland, Oregon; and Russ Hupe, Olympia, Washington.

The lesson plan was revised in November 1971. The writers suggest that continuous revision take place by people who use the ideas.

A LESSON PLAN FOR COMPARING ENVIRONMENTS

U. S. Forest Service, Portland, Oregon

It is exciting and important to make a comparison between two environments. This can provide an opportunity for a group to explore the factors that allow for differences and likenesses in at least two parts of our total environment.

After an in-depth study of two different environments, have small groups do Task A.

(NOTE: An in-depth study of a Forest Environment might include the investigation of Land Use Planning, Measuring Some Water Quality Criteria, Investigating a Forest Environment, and Environmental Habitats. An in-depth study of an Urban Environment might include the investigations of Land Use Planning, Water Quality Criteria, and Urban Investigation.) It might even be between two different ecosystems such as a forest and a meadow.

Task A: (15 minutes) Work in small groups. Analyze the data collected for each environment and do the following:

1. List some things you found out about ______________________ environment.

2. List some things you found out about ______________________ environment.

Questions and discussion:

1. List and group items on board.
2. Which things are similar in each environment?

Task B: (15 minutes) Small groups. List at least four basic functions of each environment.

______________________ environment	______________________ environment
1.	1.
2.	2.
3.	3.
4.	4.

Task C: (15 minutes) Small groups. List three factors that affect the quality of the two environments.

________________ environment	________________ environment
1.	1.
2.	2.
3.	3.

Questions and Discussion:

1. Discuss the results of Task B and C with the group and list on board next to Task A results.
2. In what way (if any) will the environments have an effect upon each other?
3. Based on your own investigations, what are some general factors that apply to both environments?
4. What reasons can you suggest for the similarities and differences between these factors?
5. Summarize the unique contribution of each area to the society.
6. Why are the items in Task A, B, and C important to the way we manage environments?

Task D: (15 minutes) Small groups. List at least four of the most obvious problems of the two environments.

________________ environment	________________ environment
1.	1.
2.	2.
3.	3.
4.	4.

Task E: (20 minutes) List at least four guidelines that you would use in planning for future land uses in both environments.

1. ________________ environment

2. ________________ environment

Task F: What can we say about Environments?

BEHAVIORAL OUTCOMES IN KNOWLEDGE

Identify four basic functions about each environment.
Describe three ways in which the environments are interrelated.
Identify three factors common to both environments.
Describe three similarities and differences between each environment.

BEHAVIORAL OUTCOMES IN ATTITUDES, AWARENESS, VALUES AND ACTION

Describe at least two unique contributions that each environment makes to society.
Identify at least three guidelines that you would use in planning for management of the environments.
Describe how you feel about man's use of each environment.
Describe your recommendations for the future management of the area.

This lesson plan, developed for use in teacher workshops by Ernie and Char McDonald, was revised in November 1971. The writers suggest that continuous revision take place by people who use the ideas.

A LESSON PLAN FOR INVESTIGATING AN URBAN ENVIRONMENT

U. S. Forest Service, Portland, Oregon

Set the stage for this investigation by reviewing quickly what will take place in the allotted time. For example: During this session we want to investigate an urban environment and collect information that will tell us about the livability, functions, needs, and problems of this community. In addition to finding out about this community, you will be developing procedures you can use with your students to investigate your own community.

I. IDENTIFYING COMPONENT PARTS OF AN URBAN ENVIRONMENT.

1. Distribute a copy of a map, of the urban area you want to investigate, to each person. (Have it large enough to make notes on when in the field.)
2. Working in small groups, list as many component parts as you can think of (Task A).

Task A: (20 minutes) Work in groups of 5 to 6. List some things that might affect the quality of the environment in this community. (Use map and past knowledge of area.) Group and label items into categories.

Questions and discussion:

1. What categories did you come up with? (List on board just as groups report e.g. human factors, land use, transportation, community facilities, etc.). If group listed individual items in the community, you may have to group and label into large categories (housing, commercial, utilities, transportation, land, etc.).
2. What criteria would you use in selecting an area of this community to study?
3. Have each group spend 10 to 15 minutes drawing boundary lines around an area they decide upon to investigate (use map passed out at first).
4. What could you do in this community to collect first-hand information about each of the categories your group decided upon?

II. CONSTRUCTING AND DEVELOPING AN INVESTIGATION

Task B: (60 minutes) Develop a plan of action to investigate your part of the urban environment. Consider such things as how to divide responsibility for collecting information, what information to collect, will you stay together or split up, most efficient ways to collect and record information, develop tools to record information.

NOTE: Information in Task B should show relationships between items from the inventory, cause and effect relationships, conflicts and complements, information should show specifics or details which help explain or clarify a relationship. Methods may include: questioning, opinion polls from residents, user counts of facilities, traffic counts, maps in greater detail, etc.

Each group give brief outline of procedure for their planned investigation of the ____________ community.

III. COLLECTING, RECORDING, AND REPORTING SURVEY INFORMATION.

Task C: (3 to 4 hours) Field investigation. Each group spend 3 to 4 hours to do a visual survey and investigation of that portion of the community decided upon, using the methods of collecting, recording and interpreting data each group developed.

Task D: (5 minutes, each group) After return from field investigation. Plan a 5-minute report that tells and shows the methods you used and the information collected in Task C. The report must use the following criteria:

a. Use more than one person as spokesman.
b. Use visual displays.
c. Include a variety of information media and methods of getting it.
d. 5-minute time limit.
e. Consider -- what you did, how you did it, what it meant.

Questions and discussion:

1. What are some component parts of the environment that you just investigated? (List on board) e.g. roads, homes, business, river, recreation.
2. In what ways are the component parts interrelated? e.g. transportation to business, buildings to public utilities, transportation to land forms, strip city development to transportation, etc.
3. How does each part of the community investigated relate to the other areas? To the total community?
4. What would happen if one whole segment of the community were eliminated? One category?
5. What examples are there in your area that:
   illustrate the past --
   typify the present --
   indicate the future --
6. What are your recommendations for meeting future needs in this area?
7. If you were the city planning commission, what guidelines would you develop for consideration of future developments in this area?
   a.
   b.
   c.
8. Identify three factors that affect the quality of your area.

IV. IDENTIFYING AND CONSTRUCTING AN INVESTIGATION OF ONE ENVIRONMENTAL PROBLEM.

Let's take an example of one interrelationship and investigate one segment of it. (Note: Pick one example such as transportation -- traffic congestion and have group list items under the following three columns, one column at a time.)

What we want to find out about the interrelationship	How to collect the information	How to record information
e.g.: (How many cars	(survey-visual count	(graph
Where they go	questionnaire	description
Where come from)	questionnaire)	map location)

Task E: (30 minutes) Work in original small groups. Select one interrelationship or problem that you identified and develop an in-depth investigation to find out more about it. Consider: What you need to find out about it, actual samples of how to collect and record information, cause-effect relationship, alternative solutions to the problem, where to collect additional data, what social and political decision-making processes are available.

NOTE: If this whole lesson is done over an extended period of time, then each group should be allowed to carry out their investigation.

Questions and discussion:

1. Have each group make a report covering points in Task E.
2. Now that we know more about the ________________________ community, do Task F.

Task F: (15 minutes) Small groups. List what you can say about your study area in relation to its: (consider past, present, future)

Functions	Problems	Needs

Questions:

1. What are the basic functions of your study area? Whole community?
2. What are some of the most obvious problems?
3. What are some of the needs of the study area?
4. Identify three factors that affect the quality of the environment in your area.
5. What impact does this survey area have on the management of your community?
6. What additional information would you like to have had before making a decision?

V. COMMUNICATING FEELINGS, AWARENESS, AND VALUES.

Task G: Describe what you would do to solve or improve the problem you identified in Task E --

as a member of a community action group --
as a part of the political decision-making process in your community.

Questions and discussion:

1. Discuss individual comments.
2. What type of community action can we take to identify and motivate people to collect, interpret data, arrive at alternative solutions and take intelligent action to decide on the best solution consistent with the needs of the environment and society.

Summary Questions:

1. What did we find out about the environment in our study?
2. How can we summarize our discussion and investigations?
3. What processes and methods did we use in our investigation today?

Task H: Describe in writing how you feel about our session today.

BEHAVIORAL OUTCOMES IN KNOWLEDGE

As a result of these activities, you should be able to:

Identify at least three factors that affect the quality of the environment.

Describe a procedure to use in initiating an environmental investigation that can take place in any urban environment.

Identify at least three component parts of an urban environment.

Describe four interrelationships that exist between component parts of the environment.

BEHAVORIAL OUTCOMES IN FEELINGS, AWARENESS, VALUES, AND ACTION

As a result of these activities, you should be able to:

Describe what you can do to become involved in community action programs of identifying and suggesting solutions to local environmental problems.

Describe how you and the community people can become involved in affecting the local political decision-making process through environmental urban investigations.

Analyze the cause and effect relationships of factors affecting the quality of the environment. (This is prerequisite to any positive change.)

Identify forces and change agents that can be used for or against an improved livability of the area.

Equipment needed

Enlarged maps of the urban area to be investigated

Blackboard or newsprint easel
Magic markers or chalk
Paper and pencils

ADDITIONAL INFORMATION

The following laboratory sheets could be used to provide additional information to people investigating an urban environment after they have completed Tasks A, B, and C. The group may identify different component parts of the environment than those listed here.

A LESSON PLAN FOR INVESTIGATING A FOREST ENVIRONMENT

U. S. Forest Service, Portland, Oregon

Set the stage for this investigation by reviewing quickly what will take place in the allotted time. For example: In the next 4 hours we are going to make some inferences of why we think some things are the way they are based on observations; test out those inferences by experimentation, collect and interpret past events in this experiment, and explore ways that we can improve the efficiency of energy cycles. (You might want to read the behavioral objectives at the end of the lesson and refer back to them as evaluation of the session.)

The following activities may help you look for observable changes, relationships, patterns and trends, in order to interpret past events, understand present relationships, and indicate future trends in the forest environment.

The processes used in this lesson plan can be replicated in any environment. Some of the activities used cannot. In environments other than a forest, you may have to develop activities appropriate to the area.

I. OBSERVING AND INFERRING WITH CROSS SECTIONS (as an example of using observable evidences to infer past events in a forest).

Distribute cross sections and task cards. Cross sections of trees can be 4 to 6 inches in diameter or larger, and should show a variety of growth patterns and influences (fire, insects, etc.).

Task A: (on cards) (5 to 10 minutes) Work with one or two other persons. Write down some things you notice about the cross sections.

Questions and discussion:

1. What are some things you noticed about the cross sections?
   (Accept all comments from group. List on board or chart.)
2. Focus on two or three items for discussion:
   Why did you say ... (your cross section had evidence of fire)? (examples)
   What could account for ... (the rings being irregular)?
   What are some things that could account for ... ?

Task B: (on cards) (10 minutes) Work with one or two other persons. Select three observations about the cross sections from the group list. List possible reasons for these observations. List ways you could set up an investigation to find out more about your observations and inferences.

Observation (what you noticed)	Inferences (possible reasons for this)	Investigations (how we could find out)
1.		
2.		
3.		

Questions and discussion:

1. Ask for reports on the above chart from several groups. (as time allows)
2. Which of these investigations could be carried out in this environment?
3. Keep your lists of observations and inferences for reference at the end of this session.
4. What could tree rings from this forest tell us about past and present events in this environment?

II. COLLECTING AND INTERPRETING DATA ABOUT TREE GROWTH RATE AND COMPETITION

Task C: (with tree cores) requires preparation by the instructor before the session.

A tree stand should be selected for study, four to five trees tagged (trees should be selected that show effects of environmental conditions -- injury, overcrowding, lack of sunlight, etc...). The tagged trees should be bored with an increment borer, by the instructor ahead of time. (Cores should be numbered corresponding to numbers on the trees. Putting tree cores in see-through plastic straws and then taping to a cardboard will help keep them longer if liquid resin is not available. In any event, keep the cores and labeled trees to use again. This eliminates the necessity of reboring the trees.

NOTE: Maybe you can find and use stumps of trees that grow under a variety of competition influences instead of tree cores.

Task C: (Part 1) (15 to 20 minutes) Work in groups of four to five persons.

1. Observe the tree core your group has been given and record the following information: (See drawing of tree core to help interpret the tree core you have been given.)

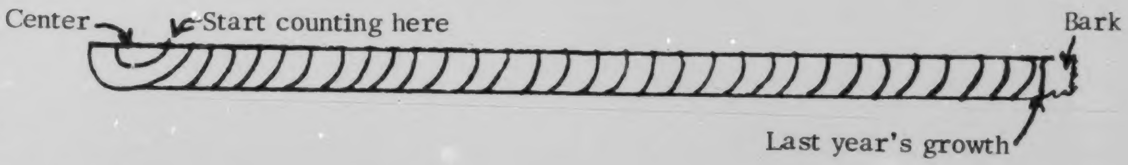
Tree #	# Dark rings from center to bark (approx. age)	# Dark rings in last inch	Remarks about the pattern of the rings

2. When your group has the above information, one person from the group should record this information on the blackboard or easel board. Chart to be like Task C, part 2.

(Part 2) (10 to 15 minutes) Work in small groups. Record the following information about tree cores from the master chart. (Instructor will provide the diameter information.)

Tree #	# Dark rings from center to bark (approx. age)	Diameter of tree trunk (cir. + 3)	# Dark rings in last inch	Remarks about the ring pattern
1				
2				
3				
4				
5				
6				

Drawing of Typical Tree Core



Questions and discussion:

1. What similarities do you notice in the data about the trees?
2. What differences do you notice in the data about the trees?

Task C: (Part 3) (20 to 30 minutes) Work in small groups. Set up an investigation to find out reasons for some of the differences in the data.

1. Select two to three trees from the list that show differences in growth rates.
2. Which trees did you select? (Indicate by number)__________
3. Why did you select these trees?__________

Go with your group to the site of the trees you selected for investigation and do (Part 4).

(Part 4) (30 to 40 minutes) Work in small groups.

Collecting and Recording Data

Record your observations:

Interpreting Data

Record possible interpretations of the above data:

Summarizing your Investigation

Write your group's summary below, including:
- what you were trying to find out
- what data you collected about it
- what interpretations you made
- what other data would you collect about your investigation?

Questions and discussion:

1. Ask for 2 to 3-minute summaries from several groups. (as time allows)
2. What problems did you encounter in this task?
3. What other data could you collect about your investigation?
4. What does the information tell us about the past events of this environment?
5. How would you summarize the major factors affecting the growth of this forest?

III. INTERPRETING PAST EVENTS

Task D: (30 to 40 minutes) Look for evidence of change (natural and man-made) in the environment. Record and fill out other columns.

Evidence of changes in the environment	What might have caused them?	Effect upon the environment

Describe the way the area around you looked: 25 years ago

Describe how you think the area around you might look: 25 years from now

Questions and discussion:

1. What evidence of change did you find?
2. What might have caused this?
3. What was the effect of __________ (this change) upon the environment?
   Allow time for interchange of ideas between group members. The same changes may have been noticed, and there may be many interpretations of their causes and their effects.
4. What do you think this area looked like 25 years ago?
5. How do you think this area will look 25 years from now?

Task E: (10 minutes) Describe in writing how you feel about the changes in this environment.

IV. INFERRING CHANGES IN A ROTTEN LOG OR STUMP

Find a rotten stump or log

Questions and discussion:

1. What things about this stump give us clues about the past events that have taken place?
2. What factors caused these things to happen?

Task F: (15 to 20 minutes) Work in groups or by yourself. NOTE: DO NOT TEAR THE STUMP APART! Discuss why.

What things are changing the rotten stump now? Record below:

*Living things	Effect on stump

*Non-living things	Effect on stump

Questions and Discussion:

1. What cycles are taking place in the rotten log or stump?
2. In the space below, construct a diagram of one of the cycles taking place in the rotten log or stump:

Task G: (15 minutes) Work in groups. Construct a diagram of one of the cycles taking place in the rotten log or stump.

V. TRANSFERRING THE PROCESS TO OTHER ENVIRONMENTS

Questions and Discussion:

1. What are some other things in this environment that could help us further interpret the landscape and what it can tell us about the landscape. List on board.
2. Using one of the items listed in one or another you can think of, do Task H.

Task H: (30 minutes) Describe in writing an alternative activity you could have done to establish a time sequence for the past events in this environment.

Describe in writing an activity you could do in a city environment to establish a time sequence for the past events in the environment.

Activity	What it would tell you about the past events in the area

Describe an activity you could do in the area around your school to establish a time sequence for the past events in the area.

Activity	What it would tell you about the past events in the area

VI. COMMUNICATING FEELINGS OF AWARENESS THROUGH SKETCHING

Distribute sketching paper, and pieces of charcoal from a campfire or fireplace.

Task I: (give these directions verbally) (Use sketching paper)

Construct a sketch using charcoal from a campfire or fireplace. Other sketching materials will be given to you as you work.

NOTE: Subject of sketch depends upon the environment.
It can be anything that is significant about the area .... rotten log, stump, or snag
an old homestead, fence, or barn
a city building, transmission tower, or freeway

While people are sketching, go around and give them:
rotten wood - brown   dandelion leaves - green   dandelion flowers - yellow
other goodies, in season
If you're not in the woods, IMPROVISE!

VII. COMMUNICATING FEELINGS OF AWARENESS AND VALUES THROUGH WRITING

Note: Begin this part when about half the people finish their sketch.

Task J: (give these directions verbally) Use your pencil or pen. Find a place on your sketch (across the bottom, or down the side) to write some things.

Write two descriptive words about the stump. (words that tell what it looks like)

Write three action words about the stump. (words that describe processes or changes taking place, or things happening to it)

Write a short phrase (4 to 5 words) that tells how the stump affects the rest of the environment. (a phrase to describe its value or usefulness) (or a phrase describing any thought you have about the stump)

Write one word that sums up everything about the stump. (a word that suggests a comparison, an analogy, or synonym)

Optional:
Now, if you wish, go back and give a title to what you have written.

Congratulations. You have just written a poem about the stump or whatever you wrote about.

Note: Pace the above directions to the needs of the group.
People shouldn't feel pressure while writing this -- be casual.
(It's good to mention that they may not wish to write something for every direction that is given.)
Review the directions now and then for people still thinking.
Have people read their writings if they wish.

Question to think about:

In what ways does this description show your feelings and awareness of the environment?

SUMMARY QUESTIONS

1. What did we find out about the environment in our session today? (list on chart, if time)
2. Why are these things important to the way we manage the environment?
3. How can we summarize our discussion? (or investigation) (What are some big ideas that would sum up what we've just said?)
4. What methods and processes did we use in our investigations?

Task K

5. Describe in writing how you feel about our session today.

BEHAVIORAL OUTCOMES IN KNOWLEDGE

As a result of these activities, you should be able to:

List at least three observations about the cross sections provided, and infer possible reasons for each observation.

Describe ways to set up an investigation to find out more about the above observations and inferences.

Set up an investigation (collect and record data) to find out reasons for growth rate differences in a given stand of trees.

Describe activities appropriate to other environments for interpreting the landscape.

Identify and list at least three evidences of change in the environment, and infer the cause-and-effect relationships of those changes.

Construct a diagram of a cycle in a rotten stump.

BEHAVIORAL OUTCOMES IN FEELINGS, AWARENESS, VALUES, AND ACTION

As a result of these activities, you should be able to:

Describe how you feel about one change in this environment.

Communicate feelings of awareness by constructing a sketch of a given object in the environment, using natural materials.

Communicate feelings, awareness, and values by describing in writing the effect of a given object upon the environment.

EQUIPMENT NEEDED

30 cross sections of trees
6 increment cores (preferably in plastic) from numbered trees
30 hand lenses (optional)
30 pieces sketching paper
lab sheets

task cards
natural materials for sketching

This lesson plan was developed for use in teacher workshops by Martha Neyland, Stevenson, Washington; Jeannie Williams, Salem, Oregon; and Charline McDonald, Portland, Oregon. The lesson plan was revised in November 1971. The writers suggest that continuous revision take place by people who use the ideas.

A LESSON PLAN FOR SOIL INVESTIGATIONS IN LAND USE PLANNING

U. S. Forest Service, Portland, Oregon

Set the stage for this investigation by reviewing quickly what will take place in the allotted time. For example: In the next 4 hours we will develop some skills and apply them to collecting and interpreting data about the soil environment and then apply that data to making some decisions about what the best uses of this land might be. (You might want to read the behavioral objectives at the end of the lesson and refer back to them as an evaluation of the session.)

I. DESCRIBING SOIL

When you first meet the group, have them sit down and do Task A.

Task A: (5 minutes) Work by yourself. Describe in writing your own description of soil. Keep this description for your own reference at the end of the session.

II. OBSERVING AND RECORDING THINGS IN THE SOIL

Distribute Task B cards and have class work in groups of three or four and report findings in 15 minutes.

Task B: (15 minutes) Work in small groups.

1. Predict what things you will find in the top few inches of this forest floor. List your predictions:

2. Stake out an area 2 or 3 feet square on the forest floor and sift through the top 3 inches of the soil, recording the evidence of plant and animals you observe.

Name or description of item in the soil	Quantity	Possible effect upon soil

3. The following three terms are used to describe organic matter at the top of the soil - litter, duff, humus. From your study above, complete the following chart:

Term and definition	Describe the feel	List the identifiable parts of plants and animals you found
Litter - (identifiable dead things on surface)		
Duff - (partially decomposed organic matter - compacted)		
Humus - (almost completely decomposed non-identifiable organic matter)		

Questions and discussion:
1. What did you find?
2. When would you expect to find more organisms? different organisms?
3. How do the organisms you found benefit the soil?
4. What are some reasons for odors in the soil?

III. DEVELOPING THE SKILLS TO COLLECT SOIL DATA

Questions and discussion:
1. Move group around to the soil profile.
2. What can we see as we look at this cross section or profile of soil?
3. What are some things that would be important to find out about it? (accept all comments)

The observable characteristics of color, texture, structure, temperature and the acidity or alkalinity (pH) of a soil are indications of some soil conditions important in land use planning.

We are going to collect and record some of this information. For the next few minutes, we will stay together as a group to develop skills in collecting soil data. After that, you will be working on your own.

NOTE to instructor: Quickly (10 minutes) go over the techniques for collecting the data with the participants. This instructional session is extremely important. The participants will use the skills they develop in this session when they collect data for the micromonolith.

Examples: (not necessary to discuss in this order)

1. Soil layers (horizons) -- Mark where the soil changes color and looks. Many soils have

three major layers or horizons, i.e. top soil, subsoil and parent material; because soil formation has many variables you may find more or less. (Measure and record the depth of each major layer.)

2. Color -- Describe and record the texture of each major layer. (Have participants pick their own description of color.)

3. Texture (how the soil feels) -- Determine and record the texture of each major layer.

   Texture is determined by feel (push and rub moistened sample between thumb and forefinger. Spit on sample to moisten.)
   If it feels gritty . . . . sand
   If it feels smooth and slick, not very sticky . . . . silt
   If it feels smooth, plastic, very sticky . . . . clay

   Note: Have samples of sand, silt, clay in cans. Have participants practice with these samples to find out what the textures feel like before determining textures of the soil profile.

4. Structure (how the soil is put together) -- Determine the structure of each major layer. Carefully break apart a shovelful of soil from each layer and match its characteristics with one of the structure on the lab sheet.

5. Temperature -- Determine and record the temperature of each layer. Plant's growth depends upon soil temperatures during the growing season. Find out your growing season before lesson.

6. pH (acidity or alkalinity) -- Determine and record the pH of each major layer. Plants need many soil nutrients to grow well. The degree of pH affects how plants grow.

   Note to instructor: Demonstrate how to use pH kit in front of whole group. Use some foreign material like cigar ashes. Mention not to compact the sample in the porcelain dish, just use enough pH reagent to saturate soil sample, match color at the edge of the soil sample and porcelain dish with pH color chart.

IV. CONSTRUCTING A SOIL MICROMONOLITH

We are going to use the skills we just developed to construct a soil micromonolith. (Explain: a micromonolith is a small cross section of this profile. You can make one by just sketching the layers on the profile sketch in Task C, or putting samples of each layer in a baby food jar, etc. Notice there is a place to check or record the data you collect, and a place to sketch what the soil looks like.

Task C: (20 to 30 minutes) Work in small groups or by yourself. Using the skills you have just developed, and the available equipment, construct a soil micromonolith of this soil profile. Record your observations on the soil micromonolith lab sheet. You may want to make a micromonolith using the cards and jelly cups; if so, ask your instructor.

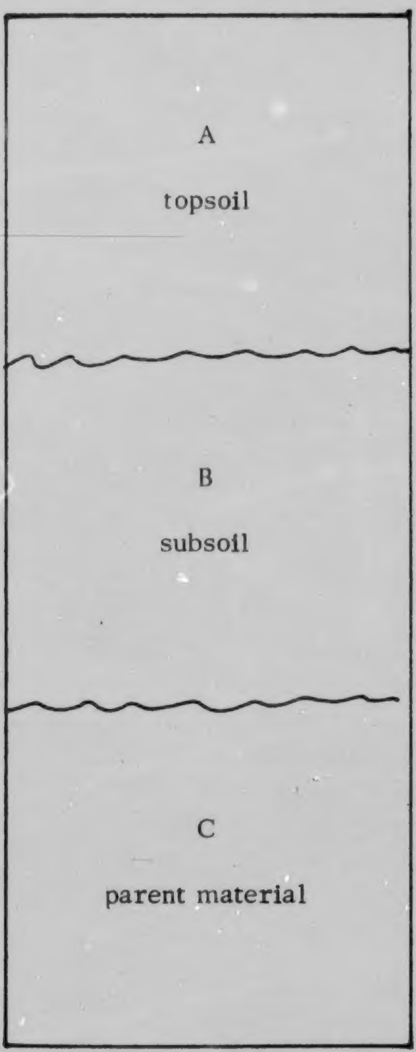
When finished with this task, report to the instructor to receive Task D.

Air temperature 3 feet above soil surface

Air temperature just above soil surface

Sketch your soil profile, label the layers or horizons and record the data.

PROFILE SKETCH



DATA

Contents of material above soil: ________________,
Depth_____" to _____". ________________________

"A" horizon (topsoil): Depth_____" to _____", Color _____, Texture: Sand_____, Silt_____, Clay_____, Structure: Columns_____, Blocky_____, Platy_____, Granules_____, pH_____, Temp._____°F, Plant Roots Visible_____. ________________________

Record below the same information as above for layers, "B" and "C."

Describe type of rock in the bedrock (if present)

V. ANALYZING YOUR SOIL DATA

Task D: (20 to 30 minutes) Work in small groups or by yourself. Use the soil data you collected and the following tables. Answer the following questions:

Effect of Soil Depth on Plant Growth and Water Storage

Deep soil (more than 42 inches) -- excellent water storage and plant growth
Moderately deep soil (20 inches to 42 inches) -- good water storage and plant growth
Shallow soil (20 inches and under) -- poor water storage and plant growth

The potential of my soil for water storage and plant growth is:
excellent_____ good_____ poor_____ Why?______________________________

Some Relationships of Color to Soil Conditions

Top soil condition	Dark (dark grey, brown to black)	Moderately Dark (dark brown to yellow-brown)	Light (pale brown to yellow)
Amount of organic material	Excellent	Good	Low
Erosion factor	Low	Medium	High
Aeration	Excellent	Good	Low
Available nitrogen	Excellent	Good	Low
Fertility	Excellent	Good	Low

Subsurface soil color (B horizon)	Condition
Dull Grey -- (if in low rainfall soils)	Water-logged soils, poor aeration
Yellow, red-brown, black -- (if in forest soils)	Well drained soils
Mottled grey -- (if in humid soils)	Somewhat poorly to poorly drained soils

a. What can you say about the following, based on the color of the topsoil, or A horizon?

amount of organic material______________________________

erosion factor______________________________

fertility______________________________

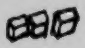
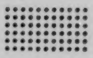
b. What can you say about the drainage in the B horizon, based on color?______________

____

Effect of texture on	Water holding capacity	Looseness of soil
Sand	Poor	Good
Silt	Good to excellent	Good
Clay	High (plants can't use it in clay)	Poor

My soil texture	Soil water-holding capacity	Looseness
Topsoil (A)		
Subsoil (B)		

Effects of structure on soil conditions

Type		Penetration of water	Drainage	Aeration
Columns		Good	Good vertical	Good
Blocky		Good	Moderate	Moderate
Granular		Good	Best	Best
Platy (low rainfall soils) (like stack of plates)		Moderate	Moderate	Moderate

Using the structures you recorded, and the chart, "Effects of Structure," what can you say about the drainage properties of your soil for:

Topsoil (A)____

Subsoil (B)____

1 — 4.5	6.5 — 7	8.5 — 14
(1 to 4.5 is too acid for most plants)	(Most plants do best here)	(8.5 to 14 is too alkaline for most plants)

Example of plants in pH range:

pH 4.0 - 5.0: rhododendrons, camellias, azaleas, blueberries, fern, spruce
pH 5.0 - 6.0: pines, firs, holly, daphne, spruce, oaks, birch, willow, rhododendron
pH 6.0 - 7.0: maple, mountain ash, pansy, asters, peaches, carrots, lettuce, pines, firs
pH 7.0 - 8.0: beech, mock orange, asparagus, sagebrush

Using the pH ranges you recorded and the table, "Examples of Plants in pH Range," complete the following chart:

Some plants that could grow here based on the pH and chart	Some plants actually observed growing here

Did your inferences about the soil pH-plant relationships check out? Yes_____ No_____

Explain:_____

Is pH the only factor affecting where plants grow? Yes_____ No_____

Explain:_____

Describe in a short paragraph how you would set up an experiment to collect data and construct your own soil pH-plant relationship chart.

Soil temperature

Soil temperature	Conditions during growing season
Less than 40 degrees F	No growth, soil bacteria and fungi not very active
40 to 65 degrees F	Some growth
65 to 70 degrees F	Fastest growth
70 to 85 degrees F	Some growth
Above 85 degrees F	No growth

The growing season for my area is_____

What does the soil temperature chart tell you?_____

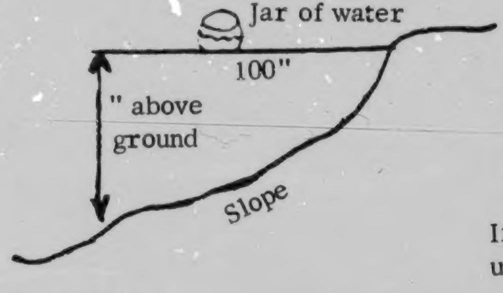
In the space below, convert the soil temperature table to a line graph. (5 to 10 minutes) Work by yourself.

VI. DETERMINING SOME LAND USES

Questions and discussion:
We have all the information we need except the slope of the land, to discuss some land uses here.

Task E: Determining the slope of the land

1. Select a place that represents the average slope of the land being studied or take several measurements and average them.
2. Place one end of a 100 inch stick on the slope you want to measure. Hold outright to be about level.
3. Place a level or jar with some liquid in it on the outright stick. Raise or lower the stick until level.
4. Measure the number of inches the free end of the stick is off the ground.
5. The number of inches is the slope of the land in percent.



If you use a different length stick, then correct by using the conversion table below.

Conversion Table

Length stick used (inches)	No. inches the end of the stick is above the ground		Multiply by conversion factor		% land
100	____	X	1	=	
50	____	X	2	=	
25	____	X	4	=	

Land Use Chart

This is a chart for soils in one kind of land, climate and plants. Other areas may require a different set of criteria.

Agriculture uses	Slope	Erosion hazard	Soil depth	Drainage	Texture
Farm crops-cultivation good soil management practices	0-3	None	Deep	Well drained	Loam or silt loam

Land Use Chart (Continued)

Farm crops-few to several special cultivation practices	3-20	Slight to moderate	Mod. deep	Somewhat poorly	Sandy loam or silty clay
Occasional cultivation many special practices	20-30	Severe	Shallow	Poor	Sand or clay
Pasture-woodland cultivation, no machinery can be used	0-2	None to slight	Deep	Well to poor	Stoney
Pasture, timber growing, woodland, wildlife, no cultivation machinery	30-90	Very severe	Deep to shallow	Well to poor	Sandy, silty, claying or rocky
Wildlife, recreation	all	None to extreme	Deep to shallow	Excessive to poor	Rockland, river wash, sand dunes

The most limiting soil factor will determine the best agricultural use of the land.

Occupancy land uses by man --

Man's valued uses of land has demanded criteria, in addition to agricultural uses, to determine proper management practices for living on the land. (Examples of others include: prescriptions for aesthetic management, soil site indices for growing timber, criteria for greenbelts, etc.)

Some uses and factors affecting that use	Slight limitation	Moderate limitation	Severe limitation
Roads and streets			
Slopes	0-12%	12-30%	Over 30%
Depth	Over 40"	20-40"	Less than 20"
Watertable	Over 20"	10-20"	Less than 10"
Building sites			
Slopes	0-12%	12-20%	Over 20%
Depth	Over 40"	20-40"	Less than 20"
Watertable	Over 30"	20-30"	Less than 20"
Septic tank filter fields			
Slope	0-7%	7-12%	Over 12%
Depth	Over 6'	4-6'	Less than 4'
Watertable depth below trench	Over 4'	2-4'	Less than 2'
Picnic and Camp Areas			
Slope	0-7%	7-15%	Over 15%

Stones	0-20%	20-50%	Over 50%
Watertable during season of use	Over 30"	20-30"	Less than 20"

Task F: (20 minutes) Work in small groups. Using the data from Task D, Task E, and the land use chart, answer the following questions.

According to the agriculture and occupancy land use charts, this land could be used for:

Agriculture use: (list and explain why)

Occupancy: (yes or no and with what limitations)

Roads and streets

Building sites

Septic tank filter fields

Picnic and camp areas

I feel the best uses of this land would be: (justify your answer)

Questions and discussion:
1. How have you classified this land?
2. Based on your observations and the data you collected, do you feel this land is being properly used?
3. In your estimation, have man's activities affected the classification of this land?
4. Could man improve the capability of this area? How?
5. How could man reduce the capability of this area?

Task G: (10 minutes) Work by yourself. Using the words from the data you collected and recorded on the soil micromonolith card, write a description of the soil in your soil study. Compare this description with the one you wrote at the beginning of the session.

Questions and discussion:
1. What are some factors that contribute to soil formation?
2. What evidences of geological changes have you noticed in this area?
3. What other factors might affect uses of the land? (climate, growing season, needs of community, economic, past history of uses, etc.)

VII. COMMUNICATING FEELINGS, AWARENESS, AND VALUES ABOUT SOIL

Task H: (10 minutes) Describe what you can do to improve the use of the soil: in your backyard and in your community.

Ask for individual descriptions and have group discuss. Relate back to comments to questions after Task F.

What types of community action can we take to identify and help solve soil and land management problems in our community? How do these relate to zoning laws, planning commissions, local and state political **decision-making?**

Take this data or processes of collecting data and identify a local land use problem and develop a simulation game similar to the Center Place game. (See Lesson Plan Outline for an Environmental Land Use Simulation Game.)

SUMMARY QUESTIONS

1. What did we find out about the environment in our study today?
2. How are soil characteristics important in environmental management?
3. How can we summarize our discussions and investigations?
4. What processes and methods did we use in our investigation today?
5. Let's review the behavioral outcomes for this session to see if we achieved our objectives. (Read list and have group comment.)

(Point out that the evaluation and testing was built into the task-oriented jobs that demanded the learner to do something.) Distribute lesson plan outlines and other materials.

Task I: Describe in writing how you feel about our session today. (Evaluation)

BEHAVIORAL OUTCOMES IN KNOWLEDGE

As a result of these activities, you should be able to:

Describe three ways in which the living organisms in the top part of the soil affect the soil.

Construct a soil micromonolith of an assigned soil profile, determine and record texture, structure, pH, temperature, and color of each layer.

Construct a written description of a soil you studied, using the words you recorded about that soil on your micromonolith.

Demonstrate the ability to determine the best uses of the land in this area, using the data from your soil micromonolith and the land capability charts.

Describe three things that man does to determine the proper management of the soil resource.

BEHAVIORAL OUTCOMES IN FEELINGS, AWARENESS, VALUES, AND ACTION

As a result of these activities, you should be able to:

Describe how you feel about man's effect on this soil environment.

Describe how you feel about man's effect on the soil environment where you live.

Describe what you can do to improve the use of the soil: in your backyard and in your community.

EQUIPMENT NEEDED: (for a class of 30 persons)

- 6 La Motte soil pH kits
- 30 micromonlith cards
- 6 tape measures
- 30 sets of lab sheets
- 3 sticks (50 or 100 inches long)
- labels to differentiate soil horizons
- 100 jelly cups and lids
- 3 soil thermometers
- 2 #10 cans of water
- 30 hand lenses
- 3 baby food jars, 1/2-full of water
- 1 box staples
- 2 shovels
- 3 yardsticks
- 3 staplers

This lesson plan was developed for use in teacher workshops by Phyllis Enger, Seattle, Washington; Dave Kennedy, Olympia, Washington; Don Cannard, Vancouver, Washington; Ernie McDonald, Portland, Oregon; and George Otte, Hillsboro, Oregon. The lesson plan was revised in November 1971. The writers suggest that continuous revision take place by people who use the ideas.

SUPERHIGHWAY -- A SIMULATION GAME

Object - To plot out a new super-highway from metropolitan area x to metropolitan area y on the map considering economic and ecological factors.

Materials - Large map of area or transparency, individual maps, role cards, work sheets.

Procedure - Introduce the large map stating that this is a hypothetical problem we have to solve. Indicate on the map the various areas of land use -- farm, ranch, timber, marsh, hill, mountains, village and city. The teacher can make a decision on the amount of discussion necessary prior to beginning game. Some of the following factors might be discussed with the class as a whole to help prepare them to make some decisions:

a. Propose various routes and discuss possible effects.
   1. If the route were to pass through or near the city, how might it affect that area.
   2. If the highway were routed south of the mountains, what effect would it bring about to the city, village and lands it passes through.

b. What might be the cost of the various routes? (This factor is built into the game as stated later.)

c. Time between cities x and y will be shorter. Areas outside these cities could be developed because of less time to drive to work areas. How might this change land use areas?

After general discussion, the students should be given a role to act out in making their decision on the route to be chosen. Each role is on a card with some information as to the role and some of the effects that might occur. Each student should be clear as to the role he has assumed, and the teacher should check to make sure role is clear to the student.

The roles are as follows:

Farmer A, B and C - Representative of the farmers for each of the three areas on the map. They are concerned with their immediate problems -- should the highway pass or not pass through their land.

Rancher A and B - Representative of ranches of the two areas on the map.

Timber owners A and B - Representative of timber owners of the two areas on the map.

City Business men - Representative of the business interests of the city.

City Residents - Representative of the residents' interests of the city.

Village Businessmen - Representative of the business interests of the village.

Village residents - Representative of the residents of the village.

U. S. Forest Service - Representative of the U. S. Forest Service. Concerned with area in mountains, hills and marshlands.

Fish and Game Bureau - Representative for fish and game protection. Concerned with area in mountains, hills, marsh lakes and rivers.

Sportsman - Representative for hunters and fishermen.

Environmental Protection Groups - Three representatives who are interested in protection of the environment.

County Planning Commission - Decision-making body of 3 to 5 students who make the final decision on which route to select on the basis of the presentation by the representatives of the various interest groups.

The roles may be assumed by individual students or in pairs of students as found appropriate to class size.

To facilitate decision-making, each of the interest groups have been assigned to a committee to develop a plan which will be presented to the county planning commission. The committees are made up of the following representatives:

Committee I

Farmer A, city businessman, city residents, timber owner B and one environmental protection representative

Committee II

Rancher A, fish and game, sportsman, timber owner A, U. S. Forest Service and one environmental protection representative

Committee III

Farmer B, farmer C, village businessman, village resident and one environmental protection representative

Once the students have their roles and have established their committees, a spokesman should be selected for each committee to present its proposal to the county planning commission.

Each student should be given a map and a work sheet so that each can individually develop a route that would be most advantageous to his interest. Then, in a committee they will discuss and determine the best route that would satisfy the interest of their committee members. This should result only after considerable discussion, bargaining and compromising.

When a route has been selected by the committee, they should prepare their proposal for presentation to the county planning commission.

The work sheet is used by the student to determine the economics of purchasing and construction of the highway.

To determine the cost of purchasing land to build the highway, a number between 1 and 4 has been used.

1. = low cost	3. = high cost
2. = moderate cost	4. = extremely high cost

On the work sheet these numbers are found in the first column.

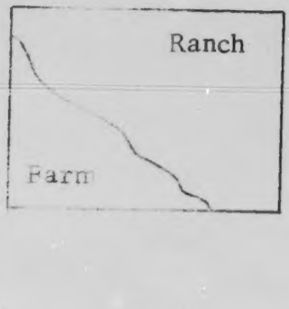
To determine the cost of constructing the highway through the various areas, a number of 1, 2 or 3 has been used.

1. = low cost 2. = moderate cost 3. = high cost

On the work sheet they are found in the second column.

To determine the cost of developing the highway, the student will count the number of squares that his intended route will cross in each area. For example, the use of the score sheet would be as follows: If the route passed through 12 squares of ranch land, 3 squares of mountains, 4 of hills, 0 of ranch, 0 of river, 4 of timber, 9 of farm, 1 village and 0 of city.

Type of land	Purchasing cost	x	Cost of development	x	Number of squares	=	Total cost
Ranch	1	x	1	x	12	=	12
Mountains	1	x	3	x	3	=	9
Hills	1	x	2	x	4	=	8
Marsh	1	x	3	x	0	=	0
River	1	x	3	x	0	=	0
Timber	2	x	2	x	4	=	16
Farm	3	x	1	x	9	=	27
Village	4	x	2	x	1	=	8
City	4	x	2	x	0	=	0
			Grand Total is sum of all totals				80



Consider area of the square crossed to that which covers the largest portion of the square; since ranch takes the greatest portion it should be counted as a ranch square. (See example at left.)

The grand total would be the economic factor presented by the individual or committee proposal. Additional factors should be considered for the proposal. Space has been given on the work sheet to write out advantages and disadvantages of the route and finally a summary taking into consideration all the factors that should be presented to the planning commission. Particularly emphasis should be placed upon considering environmental factors affected by their proposal.

The students selected for the county planning commission have a very important role to play. They are responsible for the eventual decision of which route to use and why. While the committees are in session, it will be the responsibility of the commission to set up criteria for making a decision upon choosing the most desirable route.

The use of this game is quite flexible. The involvement of the teacher in assisting in decision-making is up to the individual teacher. The maps can be colored to help identify the various areas. They can copy the color code of the master transparency or can be colored by the individual and their own key developed.

Other suggestions for use of this game would be to use the same material for locating an industrial park, a railway or any other project feasible for development.

Rancher A and B

These players represent all of the ranchers from the ranch lands A and B. The rancher from either area might have some of the following interests in the development of the highway:

1. How will this affect his use of the land?
2. What effect will the highway have on his marketing his cattle?
3. What types of future development might occur which would affect the rancher?
4. What effect will the highway development have on the natural environment.

Farmer A, B and C

This player represents the farmers for area A, B and C (need three cards). The farmer might have some of the following interests in the development of the product:

1. How will the highway development affect his land value?
2. How will the highway development affect his market for his farm products?
3. What types of future development might occur which would affect his farm products?
4. How will the highway's development affect the farmer's taxes?

City Businessman

This player represents the businessman of the city. The businessman might have some of the following interests in the highway development:

1. What new business might be developed as a result of the highway?
2. How might the highway affect the availability of goods in the city?
3. How might the highway affect the population of the city?
4. Will the highway cause any change in goods which might affect prices?

City Resident

This player represents the resident of the city. The resident might have some of the following interests in the highway development:

1. What effect will the highway development have on land values?
2. What effect will the highway development have on population growth?
3. What effect will the highway development have on taxes?
4. What effect will the highway development have on the appearance of the city?
5. What effect will the highway development have on environmental quality (air, sight, noise pollution)?

Village Businessman

This player represents the businessman of the village. The businessmen of the village might have the following interests in the highway development:

1. What effect will the highway have on availability of goods?
2. What new businesses might be possible as a result of the highway development?
3. How will the highway development affect the population of the village?
4. Will there be a change of goods which will affect prices?

Village Resident

This player represents the residents of the village. The village resident might have some of the following interests in the highway development:

1. What effect will the highway have on land values?
2. What land will change in use and what effect will that have on the village?
3. Will the highway development have any effect on taxes?
4. What effect will the highway development have on environmental quality (air, noise, pollution)?

Timber Owner

This player represents the owner of timberland A or B. The timberland owner might have the following interests in the development of the highway:

1. What effect will the highway development have on the environmental quality (air, water, noise, sight pollution)?
2. What effect will the highway development have on population of the area?
3. What effect will the highway have on the use of the forest?

Environmental Protection Society

This player represents the agency of the government that has the responsibility for the welfare of the fish and game. This bureau might have some of the following interests in development of the highway:

1. What effect will the highway development have on the water?
2. Will this highway change the use demand of the lakes, rivers and game areas?
3. What future development or land uses might occur as a result of the highway development?

Sportsman

This player represents the sportsmen. The sportsman might have some of the following interests in the highway development:

1. What effect will the highway development have on the number of persons using this land?
2. What effect will the highway development have on habitat for wildlife?
3. What effect will the highway development have on the natural environment?
4. What future developments might occur as a result of the highway development?

County Planning Commission (3 to 5 members)

These players represent the decision-making body which will evaluate the proposed routes. This group will not develop its own route but rather must develop criteria for evaluating the routes proposed by the committees. (These are examples and not complete -- the commission should expand these.)

1. What effect will each route have on the natural environment?
2. Which route will have the most favorable costs?
3. Which route will benefit the greatest number of people?
4. What effect will each route have on possible future development?

The commission might develop a worksheet for rating each proposal so that they can compare them.

Forest Service

This player represents the Forest Service Agency. The Forest Service might have some of the following interests in the development of the highway:

1. What effect will the highway development have on the environmental quality (air, water, noise, sight pollution)?
2. What effect will the highway development have on population of the area?
3. What effect will the highway have on the use of the forest?

Fish and Game Bureau

This player represents the agency of the government which has the responsibility for the welfare of the fish and game. This bureau might have some of the following interests in the development of the highway?

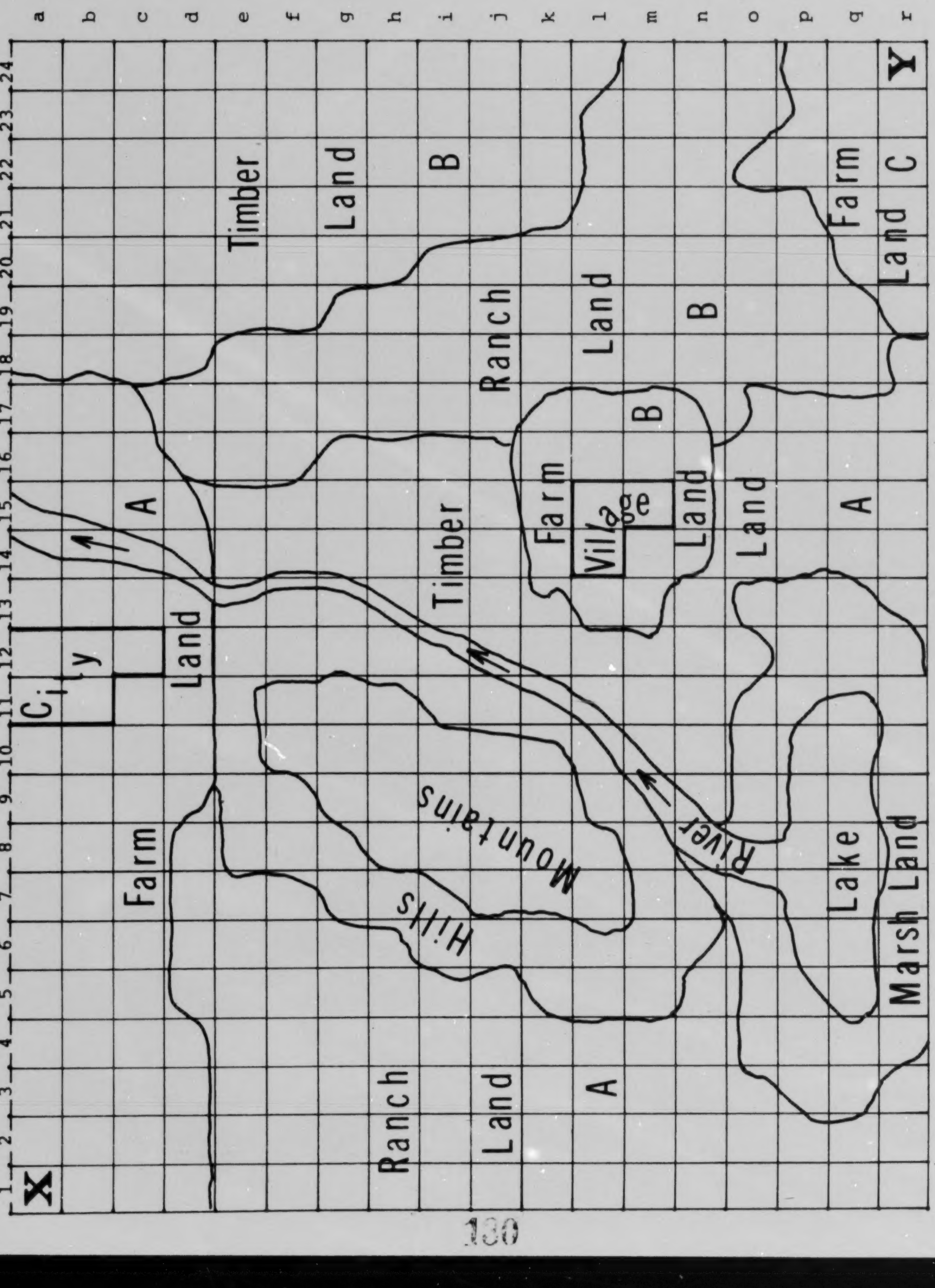
1. What effect will the highway development have on the water?
2. Will this highway change the use demand of the lakes, rivers, and game areas?
3. What future development or land uses might occur as a result of the highway development?

WORKSHEET

Type of land	Purchasing cost	x	Cost of development	x	Number of squares crossed	=	Total cost
Ranch	1	x	1	x		=	
Mountains	1	x	3	x		=	
Hills	1	x	2	x		=	
Marsh	1	x	3	x		=	
River	1	x	3	x		=	
Timber	2	x	2	x		=	
Farm	3	x	1	x		=	
Village	4	x	2	x		=	
City	4	x	2	x		=	
					*Grand total	=	

List advantages and disadvantages of your route below.

Reason for selection of route (consider ecology, cost, effect on future of the area, etc.).


X
Y
a b c d e f g h i j k l m n o p q r
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
City
Farm Land A
Timber Land B
Ranch Land B
Farm Land C
Farm Village Land B
Land A
Timber Land
Farm Land
Ranch Land A
Mountains
Hills
River
Lake
Marsh Land

Lesson Plan - Land Use Simulation Game

U. S. Forest Service, Portland, Oregon

I. Inferring, recording and classifying possible uses of land.

A. Distribute Task A, Centerplace City land use problem.
  1. The problem is to determine some possible uses for the one square mile (640 acres) of county farm land, 4 miles northeast of the city. It is now available for the city's use.
  2. Project map of Centerplace City area on screen with overhead projector.

B. Questions and discussion
  1. "What are some possible uses for the undeveloped land?"
    a. As people respond, write all comments on board, just as they say them. Don't paraphrase for them unless they are too wordy, in which case, ask: "How shall I write that on the chart?" If they give major categories right away, like Recreation, or Industry, say, "Can you give me an example of that?"
    b. Number the items as you go along -- they can refer to them by number later. When you get 15 or 20 items, STOP.
  2. "Which of these uses are similar?" Designate similar uses by letters -- A by all of one group, B the next, etc.
  3. "What label could we give to all the items in A?" e.g. Recreation, Industrial, Utilities, Housing, Commercial.

II. Developing and giving presentations.

A. Divide the class or group into the number of categories decided on (shouldn't be more than 6 to 10 in each group), and assign each group to one of the use categories.
  1. Each group is to represent the user group assigned.
  2. Pass out Task B. You have 10 minutes to list and analyze possible land uses within your land use category. Consider those listed on the board plus any other possible uses you can think of in your category.

B. Now go on to Task C -- you have 20 minutes to plan a strategy and develop a 4-minute presentation to be made to the board of county commissioners.
  1. This presentation will be a proposal for developing the undeveloped farm land.
  2. You must have a visual display such as a land use map drawing as a part of your presentation.
  3. More than one person in your group must help in making the presentation.
  4. Pass out a photocopy of the map of the Centerplace City area to each group for use in preparing their presentation.

C. Ten minutes into Task C, go around and select one person from each group to meet together as the county board of commissioners.
   1. Take the board into another room and tell them they will be responsible for hearing the presentations and deciding which one is best.
   2. Give each board member Task C_1.
   3. Tell the chairman that he or she will conduct the meeting. A timekeeper will indicate time, and the chairman is responsible for cutting off presentations.
      a. Permit 1 to 2 minutes of questions from the board members and 1 minute of questions from the audience.

D. Have Board of Commissioners enter room and sit up front.
   1. After presentations are completed, the board retires to select the best proposal.
   2. While the board is out, discuss the feelings and sense of identification of group members with their proposal.
      a. How did you feel as a person in developing and making the presentation?
   3. Board of commissioners returns, announces their decision, gives reasons for the decision and the criteria used in making it.

E. Discussion
   1. What additional data would you have liked to have had for your groups? List on board, e.g.: topography, vegetation, economy of area, railroad, shopping center, adjacent land, climate, soil survey, historical information, flood plain, wildlife, interest of board of control, money available, educational needs, reg. by State, existing zoning, political climate, population (age, needs, race, jobs).

   (NOTE: This is one of the most important parts of the activity because it emphasizes that we need a variety of information and data before we can intelligently make a land management or environmental decision to best meet the needs of people and their environment.)

Land Use Simulation Game

Task A: (10 minutes) Work by yourself.

One square mile of unused county farmland, 4 miles northeast of the city is now available for the city's use. Read the background information for Centerplace City, and then list some possible uses of the vacant farmland.

Background Information Sheet: Centerplace City

The population is 250,000 and rapidly increasing.
The city's boundaries are being extended, but the suburban fringe is expanding even more rapidly.
The rapid population growth is accompanied by demands for more housing, more jobs, additional city services, and recreational areas.
The power for industrial uses, adequate public transportation, and a skilled labor force are available.
The city is located near forests, which are to the north.
The land to the east is devoted mainly to farming.
The Pipe River is unpolluted and is the source of irrigation water as well as the municipal

water supply.

The river is too small for freight transportation, but logs could be floated on it.

The gravel bed of the river is appropriate raw material for concrete manufacture.

The present sewage treatment plant and garbage disposal area are at maximum capacity.

The citizens of Centerplace are concerned about the maintenance of a scenic regional environment.

The county board of commissioners is the authority for land zoning and many citizens' groups are developing to influence zoning decisions.

List possible uses of the land below:

Task C_1 (10 minutes) In the next 10 minutes you are to:

1. Select a chairman to call on the groups and to chair the board meeting.
2. Develop the criteria you will use in evaluating the proposals based on the needs of the people and characteristics of the land.
3. Develop some kind of matrix to evaluate the presentations while they are being given.
4. After the presentations have been made, you must announce your decision and give reasons for your selection.

Presentation	Criteria

Lesson Plan - The Tragedy of the Commons

prepared by
Herbert L. Archibald, assistant professor of wildlife ecology, Purdue University

I. Introduction

A. Divide class into groups of 4 to 6, and have each group move to an assigned table.
  1. Hand out Task A, Parts 1 and 2.

B. Show film "The Tragedy of the Commons."
  1. Avoid giving any introduction; simply say that the film concerns issues crucial to all of us.
  2. At each of the four question mark points in the film, stop the projector and turn on the lights for a short group discussion.
  3. Summarize the group discussions as suggested below.

II. Film Sequence

A. Part 1 - the concept of the commons
  1. After about 5 minutes of group discussion, have each group select a spokesperson to present the group's ideas. Summarize ideas of groups.
  2. Possible questions
    a. Why do you think the herdsmen let what happened, happen? (Overexploitation of a commons results from the attempt of each herdsman to maximize his individual worth.)
    b. Who is responsible for a commons? (No one.)
    c. Do we have any commons today? (Air, water, public lands, parks, schools, etc.)
  3. Transition - "Let's see what the next part of the film can do toward answering our questions."

B. Part 2 - distribution of resources
  1. Summarize ideas of groups.
  2. Possible questions
    a. What did the cowboy scenes mean to you? (Some behaviors were appropriate acts when population densities were low. Morality of an act depends in part on the context.)
    b. Why do you think there were cowboy and city scenes together in this part of the film? (Overcrowding; competition for resources - the commons.)

C. Part 3 - crowding and stress
  1. Summarize ideas of groups. Let students discuss their ideas.
  2. Transition - "Let's see if Part 4 can help us with this dilemma."

D. Part 4 - population control on a finite earth
  1. Summarize ideas of groups.
  2. Possible questions
    a. What ways to control human population were brought up by the film?
    b. What consequences do you see as a result of letting parents make the decision about the size of their own family?
    c. Can we have maximum good for all people as well as have a maximum population? (No.) Which is the more rational choice? How can this choice be implemented?
    d. Is the earth a commons?

(Reference: Instructional Guide for the Film: The Tragedy of the Commons)

The Tragedy of the Commons

List names of people in your group:____

____

Task A: (5 to 10 minutes per discussion) Work in groups of 4 to 6. The film which you are about to see will be stopped four times for discussion within your group.

1. What issues were raised in this part of the film?

2. What were the major issues brought up by this part of the film? What does this part of the film have to do with the commons which was brought up in Part 1?

3. What seem to be the major problems or parts of problems that have been raised so far in the film? Can you think of alternative ways that man could use to solve these problems?

4. What solutions does this part of the film suggest to problems you have identified previously?

Lesson Plan - Environmental Quality

prepared by
Herbert L. Archibald, assistant professor of wildlife ecology, Purdue University

I. Identifying environmental problems

A. Hand out Tasks A and B.

B. Briefly introduce and show film "1985" (3 reels).
   1. Question during reel changes. How many problems have you got on your list so far?

C. Have students complete Task B immediately after the film.

D. Questions and discussion.
   1. How did you feel about the film?
   2. Where did the scenes of pollution come from? Do you think they were staged? Or, do they all exist now?
   3. Do you think a large-scale environmental disaster like this will happen? Within the next 15 years?

E. Divide class into groups of 4 to 6, and have each group move to an assigned table.

F. Hand out Task C.

G. Questions and discussion.
   1. What categories did you come up with? (List categories and problems on board as students report. Reorganize as necessary when list is complete.)
   2. What kinds of interrelationships between problems did you find?
   3. What are some of the causes of these problems? (Misguided economic incentives, apathy, values, population growth, technology, mobility, urbanization, information gap, limitations of governmental units.)
   4. How can some of these problems be solved?

II. Developing criteria for defining environmental quality

A. Hand out Task D.

B. Questions and discussion
   1. What criteria did you come up with? (List categories and criteria on the board as students report. Reorganize as necessary when list is complete.)
   2. Was it difficult for your group to agree on criteria? Would it be even more difficult for a larger and more diverse group to agree on a set of criteria for a quality environment?

3. Are there areas in Indiana that meet all these criteria? What areas most obviously do not?
4. How could a community go about improving its environmental quality? Will this happen if you leave the task to others in the community in which you settle after college?
5. How are these environmental quality criteria related to the environmental problems we listed earlier? (Positive-negative of same thing, e.g. water pollution-clean water.)

Environmental Quality

Task A: (60 minutes) Work individually. Identify and list the problems shown in the film "1985."

Task B: (10 minutes) Immediately after film. Describe in writing your reaction to the film "1985."

List names of people in your group:____________________________________

____

Task C: (15 minutes) Work in groups of 4 to 6. Group the problems identified in Task A into categories. Describe some of the ways in which the categories you have selected are interrelated.

Task D: (30 minutes) Develop a set of criteria for what you consider a quality environment. List items, and group into categories.

Lesson Plan - Household Investigations.

prepared by
Herbert L. Archibald, assistant professor of wildlife ecology, Purdue University

I. Identifying component parts of a household.

  A. Divide class into groups of 4 to 6 (to make about 5 groups) and have each group move to an assigned table.

  B. Hand out Task A.

  C. Questions and discussion.
    1. What categories did you come up with? (List on board as groups report.)
    2. How could these categories be rearranged as components of an ecosystem?
      a) Inputs - materials
        water
        energy
      b) Outputs - sewage, runoff
        solid wastes
    3. Finalize categories and assign one to each group.

II. Constructing, developing and doing an investigation.

  A. Hand out Tasks B and C.
    1. Answer questions raised.

III. Reporting the results of the investigation.

  A. Hand out Task D after about 30 minutes of group work on Task B.
    1. Tell where to get ditto masters, duplication, paper, magic markers, etc.

  B. Questions and discussion following reports.
    1. How are some of the component parts of the household related? (List on board.)
    2. How does each part of the household investigated relate to the total community?
    3. What would happen if one component of the household was eliminated throughout a community? (e.g. garbage strike, water shortage, blackout, etc.)
    4. What are your recommendations for meeting future needs in this area?

Household Investigations

List names of people in your group:____

____

Task A: (15 minutes) Work in groups of 4 to 6. List some things about the typical middle-class American household that might affect the quality of the environment. Label items, and group into categories.

Task B: (45 minutes) Develop a plan of action to investigate the environmental effects of your part of the typical middle-class American household. Consider such things as how to divide responsibility for collecting information, what information to collect, most efficient ways to collect and record information.

Task C: (3 to 4 hours) Field investigation. Spend 3 to 4 hours collecting information on your part of the typical household and its effect upon the environment, using the methods of collecting, recording and interpreting data which you have developed.

Task D: (15 minutes for each group) After field investigation. Plan and give a 15-minute report that tells and shows the methods you used and the information collected in Task C. Following your report, ask for and answer questions and comments from members of other groups.

Your report must follow these criteria:
1. Use more than one spokesperson
2. Use visual displays
3. Prepare (in advance) a one-page, typed ditto handout summarizing your methods and findings (see T.A. or instructor for ditto masters and duplication).
4. Time limits - report, 15 minutes; question-answer period, 5 to 7 minutes.
5. Consider - what you did, how you did it, what it means.

Task E: (10 minutes) Work individually. Describe in writing how you feel about this investigation.

TESTING FOR AIR POLLUTION

U.S. DEPARTMENT OF AGRICULTURE

Science Study Aid No. 5

TEACHER'S INTRODUCTION

Air pollution is a problem for most Americans. Whether they live in a rural or urban area, their environment is affected by pollutants in the atmosphere.

The three experiments in this Science Study Aid are designed to provide the teacher with some basic air pollution activities. The first experiment involves particulates, the second deals with microorganisms, and the third looks at gases in the atmosphere.

The experiments give students an opportunity to observe the presence of pollutants in their own environment. They will see pollutants which will always be a part of the air they breathe—such as microorganisms. And they will find other pollutants, such as particulates and acid gases.

The experiments are written so that you may reproduce them for distribution directly to your students if you wish.

Testing for Air Pollution was developed by Miss Artice Dunbar, an elementary-science specialist with the District of Columbia Public Schools, working with scientists at the U.S. Agricultural Research Center, Beltsville, Md.

All Science Study Aids produced by the Agricultural Research Service have been developed by teachers working with the research staff. They have been tested in the laboratory and in the classrooms of cooperating teachers.

Science Study Aids are not intended to be complete teaching units. They can supplement your regular program by providing you and your students with up-to-date, research-related activities. They are public information—not copyrighted—and may be reproduced without authorization.

If you are not on our mailing list and would like to receive single copies of other Science Study Aids as they are produced, write to: Educational Services Branch, U.S. Agricultural Research Center, Beltsville, Md. 20705. Be sure to include your ZIP Code number in your return address.

EXPERIMENT I: Air Particle Test

Introduction

Solid particles of such things as soot, dust, and pollen are sometimes suspended in the air we breathe. They come from fuel combustion, construction projects, and harvesting operations, plus a host of other manmade and natural sources. Eventually these particles are inhaled by men and animals, fall into water supplies, or settle on surfaces as dust or sometimes thick grime.

Some kinds of these particles, or particulates, can make men and animals sick. Some foul water supplies, and others blacken buildings and coat windows with sludge.

Objective

To collect, observe, and test particulate matter from the atmosphere..

Materials

Filter paper
Balance or laboratory scales
Glass jar or beaker
Distilled water
Magnifying glass
Tape and thumb tacks
pH tester - litmus paper (or universal pH indicator paper)

Procedure

1. Record the weight of each piece of filter paper you plan to use.
2. Select one or more exposure sites for the filter paper; any place where dust collects will do. Weigh any tape used to secure the filter paper at the exposure site.
3. After 3 to 7 days weigh the filter paper again. Note any increase in weight or change in color of the paper (fig. 1).
4. Use the magnifying glass to note the different sizes, colors, and shapes of particles collected on the filter paper.
5. Put some distilled water in a beaker or jar. Test the pH of the water and save the litmus paper.
6. Rinse the particles off the filter paper into the beaker and observe the particles with a magnifying glass.
7. Test the pH of the water with the particles suspended in the water. Compare the litmus paper to that used to test the distilled water in Item 5. Save both litmus papers.
8. Obtain a sample of particulate from a source such as an air conditioner or furnace filter. Rinse the particles into another beaker of distilled water. Observe what happens to the particles, check the pH, and compare the litmus papers.

Discussion Questions

1. Did you find evidence of air pollution particulates in your own environment?
2. Did you find that in a short time a significant buildup of particles can occur, even on a small piece of filter paper?
3. Do particulates differ in size, shape, and color?
4. Although particulates remain suspended in the atmosphere, do they differ in density and solubility?
5. Does particulate matter from a home filter hold acid chemical compounds which will dissolve in water?

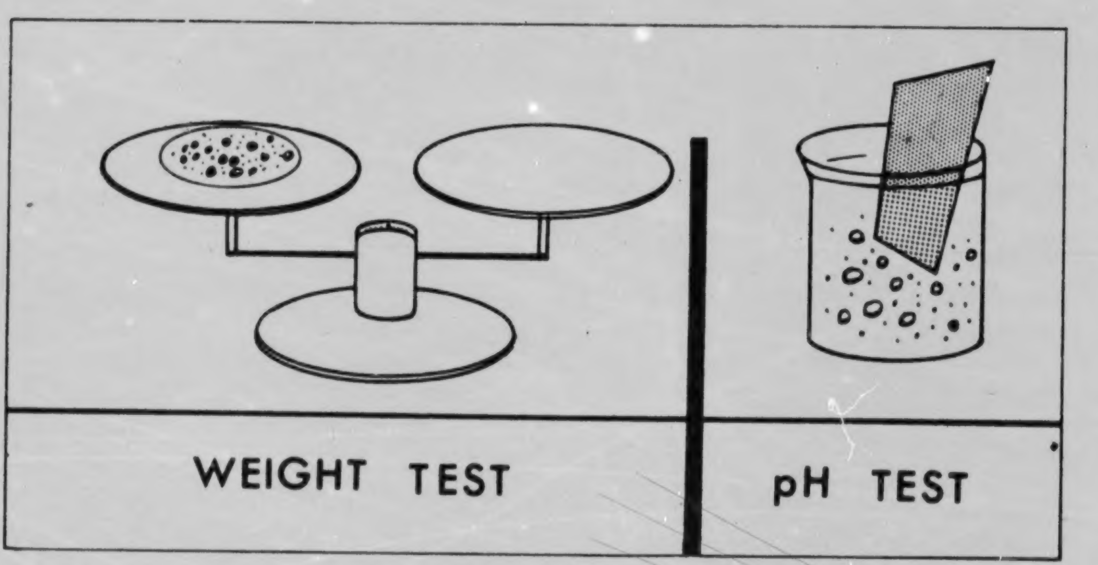

WEIGHT TEST
pH TEST

Figure 1.–Weighing filter paper and testing pH of water.

NOTES:

EXPERIMENT II: Testing for Microorganisms

Introduction

The air we breathe is filled with living cells called microorganisms. Although their presence in the atmosphere is not out of place, microorganisms are pollutants.

Some microorganisms are disease bearing. Others pass through the body system of men, plants, and animals every day without causing any harm.

Objective

To collect, grow, and observe different kinds of microorganisms present in the atmosphere.

Materials

10 sterile petri dishes—or sterilized, shallow, clear jars may be used

About 200 ml. of nutrient agar—such as potato dextrose

Magnifying glass

Thermometer

An incubator—or any place where the temperature can be maintained at 25° to 35° C. (77° to 95° F.) for 24 hours. The temperature used should be recorded.

Procedure

1. Melt the agar and cool it to about 45° C. (113° F.).
2. Pour 15 to 20 ml. of agar into each petri dish. Depending on their size, the jars may need slightly more agar. Cover the dishes immediately.
3. Expose each dish to a different air sample for 15 to 30 minutes. Use sites where there is a free flow of air, such as a windowsill, or a place near a fan or ventilation inlet. Also cough directly on one dish two or three times. Breathe on another dish for about 3 minutes. Cover all dishes immediately after exposure.
4. Incubate for 24 hours at 25° to 35° C (77° to 95° F). Colonies of microorganisms should begin to grow on the agar.
5. Observe the microorganisms and record the data on a chart like the one shown in figure 2. Show the totals in the form of a bar graph.

Discussion Questions

1. Is there a variation in the number of colonies that develop in the agars, depending on the exposure site?
2. Do the dishes exposed to human microorganisms show the most colonies?
3. Is there a difference in the color of the colonies in each dish? What would cause this effect?
4. Do the colonies differ in size and shape? Why?

NOTES:

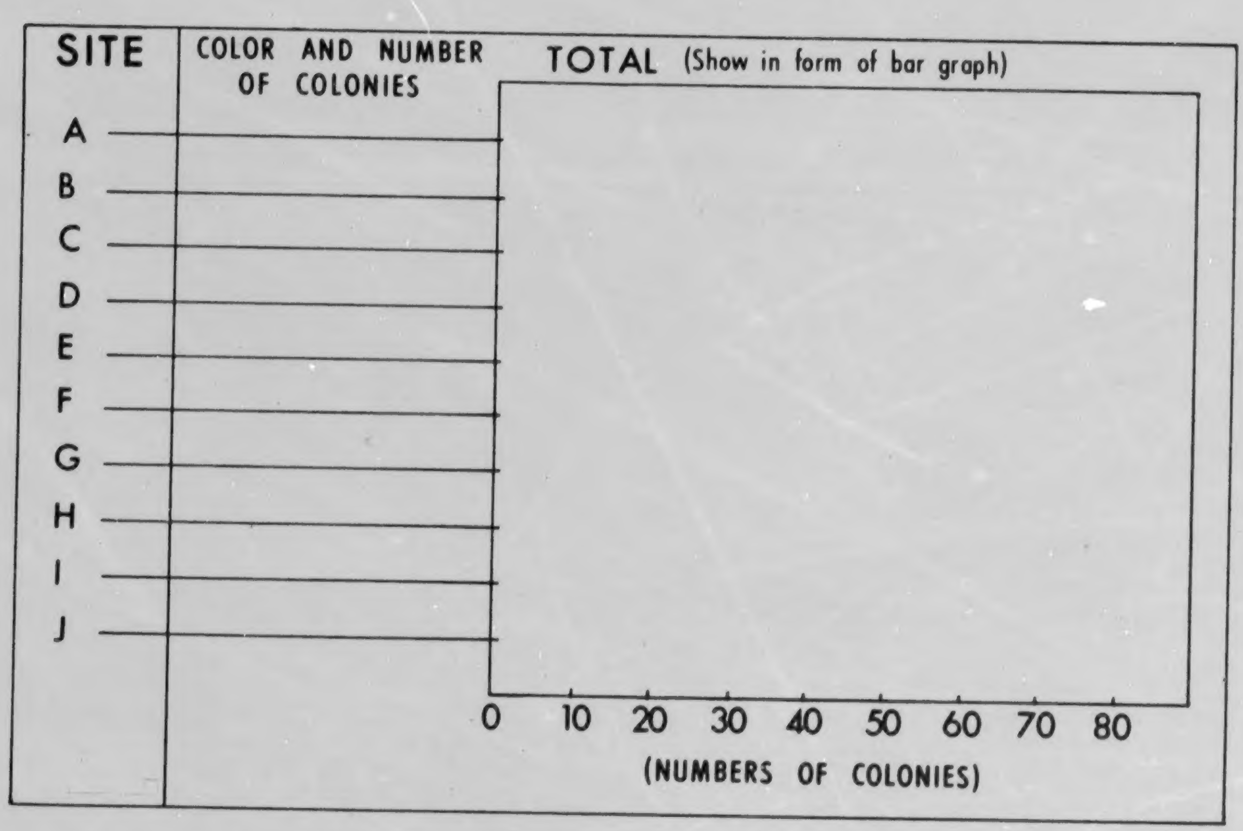


Figure 2.—Chart and graph for Experiment II.

NOTES:

EXPERIMENT III: Testing for Acid Air

Introduction

Acid gases are prime ingredients of urban air pollution. These gases may damage plants, corrode metals, crumble stone, and in heavy concentration they can sicken men and animals.

Objective

To test air samples for their acid content.

Materials

A large funnel.

An air pump or aspirator—most pet shops sell air pumps.

Filter papers—one for each exposure site, large enough to cover the large end of the funnel.

Tape to hold filter paper on funnel.

One ounce of 0.01 M sodium bicarbonate solution.

One ounce of 0.1-percent methyl orange indicator—pH 1-3.

One ounce of glycerin.

Two or three ounces of a dilute solution of 10-percent hydrochloric acid in a beaker.

Three eye dropper bottles.

Two or three feet of rubber or glass tubing.

Chart and graph.

Procedure

1. Cut filter paper big enough to fit over the large opening of the funnel with a 1/2-inch overlap. Tape it on.
2. Add a drop of glycerin to the center of the paper.
3. Add a drop of the indicator solution to the center of the paper. More drops may be necessary if the color is not apparent.
4. Add a drop of sodium bicarbonate solution to the center of the paper.

   NOTE: Support the filter paper with a piece of wire screen cut to fit over the opening of the tunnel if the moistened paper cannot withstand the flow of air through it without rupturing. Place the screen on the funnel, then place the paper over it. Secure both with tape or a rubber band.

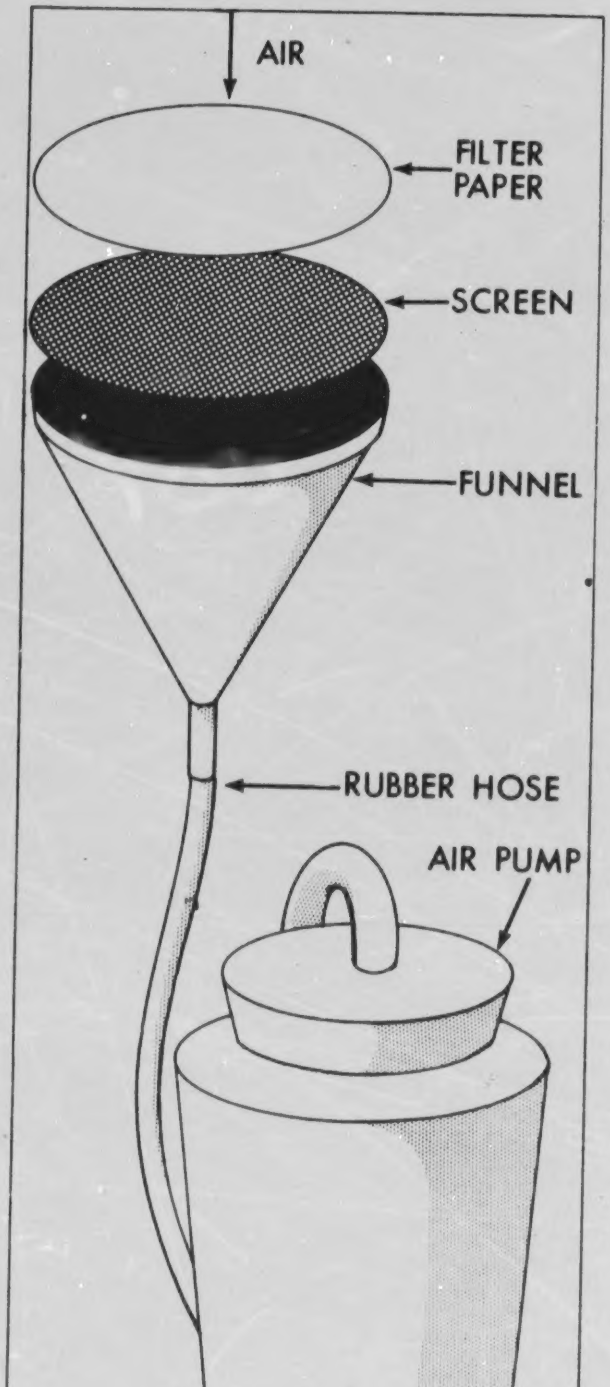


Figure 3.—Equipment setup for Experiment III.

5. Attach the tubing to the small end of the funnel and to the air pump.
6. Start the air pump and the timer. Do a preliminary test, drawing air from above the open bottle of dilute hydrochloric acid. Stop the pump when a red color is visible.

7. Test some air:
    a. Drawn from a chemistry laboratory.
    b. In a chemistry storeroom.
    c. Outdoors.
    d. In a kitchen.
    e. From exhaled breath.
    f. From the exhaust of an automobile.
    g. From any other source you can think of.
8. Make a record of the results on a chart and bar graph to illustrate the presence of acid gases at the test sites. Record on the chart the site location, the time you started taking the air sample, and the time the treated filter paper began to react with the gases (fig. 4). Show the elapsed time figures in the form of a bar graph. Then you will have a complete picture of the acid gas concentrations encountered in the test.

Discussion Questions

1. Are acid gases present in the air?
2. Do gas concentrations differ, depending on the source and the air circulation at the exposure site?
3. What are the possible sources of acid gases which could account for the reactions observed?

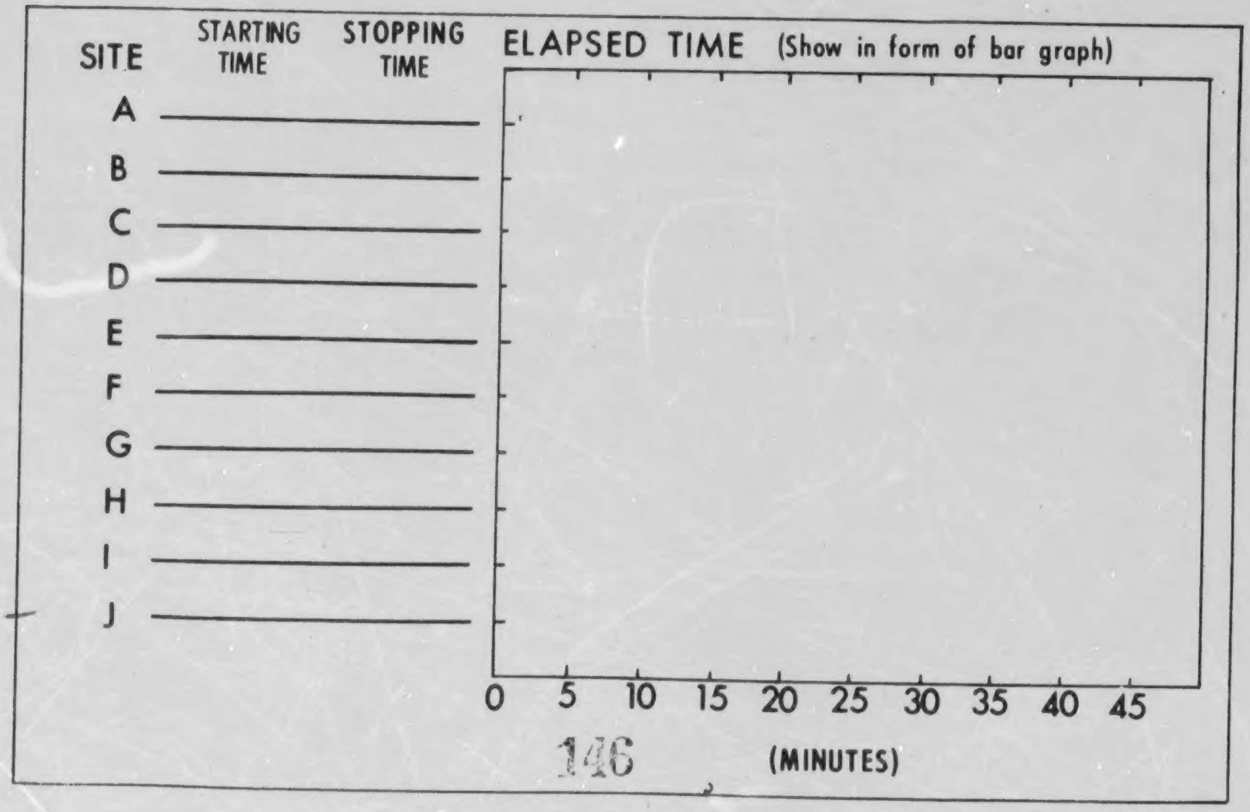


Figure 4.—Chart and graph for Experiment III.

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Prepared by

Information Division
Agricultural Research Service

NITRATE WATER ACTIVITIES

U.S. DEPARTMENT OF AGRICULTURE

Science Study Aid No. 4

TEACHER'S INTRODUCTION

This Science Study Aid provides background information, related activities, and suggestions for other activities on the subject of nitrate as a water pollutant. With this background, the student and teacher will be able to develop followup activities relevant to the situation in their community.

It would be helpful if the student has some knowledge of how water leaches materials from the soil. The student should also be familiar with titration techniques and the nitrification and denitrification processes. Several references and suggested activities relating to the nitrate-water problem are listed in this Science Study Aid. They offer relevant background information as well as opportunities for students interested in additional study.

Objectives

Completion of these activities should enable the student to:

1. Run an accurate nitrate analysis of a water sample.
2. Explain the rate of nitrate use by plants in relation to their life cycle.
3. Explain how filtration reduces the nitrate content of water.
4. Write additional activities or adaptations of the material.

Suggested Use

You may wish to reproduce the following material for distribution to students. A general background statement begins on page 2. Two activities follow. One is a method for removing nitrate from water, and the other is a method for measuring nitrate used by plants in different stages of growth. The third part of this Science Study Aid describes a technique for measuring the amount of nitrate in water. This measuring technique is necessary to carry out the two activities.

Nitrate Water Activities was developed by Joan Valieant and Jerry L. Southland. Miss Valieant is an environmental curriculum development specialist with the Montgomery County school system in Maryland. Mr. Southland is a junior high school teacher in Grand Rapids, Michigan. They worked closely with soil scientists at the Agricultural Research Center at Beltsville, Maryland.

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BACKGROUND INFORMATION

Providing adequate water to meet the increasing demands of our society is becoming an enormous problem. The Nation's research community is responding by focusing more and more of its attention on ways to conserve and recycle water.

The United States has an average annual rainfall of 30 inches. About 21 inches of this returns to the atmosphere as transpiration from plants or evaporation from soil and water. The remaining 9 inches of rainfall is natural runoff water. Increased withdrawals from this relatively constant water supply will require more recycling of water for reuse.

Some experts predict that multiple reuse of water will be necessary by 1980, when withdrawals of water will equal or exceed the supply. In water-short areas, such as exist in the Southwest, waste-water reuse has already arrived.

What we are talking about then is reuse of "used" or "polluted" water that may have to be reconditioned. Eight general categories of pollutants are: common sewage and other oxygen-demanding wastes; disease-causing agents; plant nutrients; synthetic organic chemicals; inorganic chemicals and other mineral substances; sediment; radioactive substances; and heat.

The accompanying science activities are related to plant-nutrient pollution. Plant nutrients support and stimulate the food chain of aquatic life, such as algae and water weeds. Nitrogen and phosphorus are the two chief nutrients present in small amounts in natural water; much larger amounts are contributed by sewage, certain industrial wastes, and drainage from fertilized lands.

When the concentration of nutrient minerals in lakes and rivers becomes too high, growth of water plants usually becomes excessive. The water may then become undesirable for domestic and recreational uses.

Cities, livestock operations, and food processing plants all concentrate food, feed, and agricultural products. Once digested or processed, these products return to our environment as sewage, manure, or processing wastes. Biological waste-treatment processes do not remove the nutrients—in fact, they convert the organic forms of these substances into mineral form, making them more usable by plant life.

Although sewage provides the major source of plant nutrients added to our water, chemicals in runoff from agricultural lands have also been blamed as one of the prime contributors to over-enrichment (eutrophication) of surface waters.

More information is needed for evaluating the amounts and sources of agriculture's contribution to this eutrophication problem. Fertilizers, for example, are now being applied at higher rates than formerly because they are cheaper and because of the economic need to get the largest crop returns per acre. This increased use of fertilizers could increase concentrations of chemicals in agricultural runoff.

Because nitrogen is highly soluble, many people are quick to associate statistics on the rapid expansion of fertilizer use with suspected increases in water pollution from nitrate; however, the behavior of nitrogen in soil is highly complex. In addition to the nitrogen added to the soil in the form of fertilizers, there are at least five other sources to consider. They are:

1. The organic matter in the soil and the rate at which soil organisms convert it to nitrate.
2. The atmospheric nitrogen that is fixed either symbiotically or nonsymbiotically by microbial action in soil.
3. The nitrogen involved in crop utilization and leaching.
4. The nitrogen assimilated by microorganisms.
5. The nitrogen returned to the atmosphere.

In the dynamic soil-plant system, these processes take place simultaneously. Thus, when

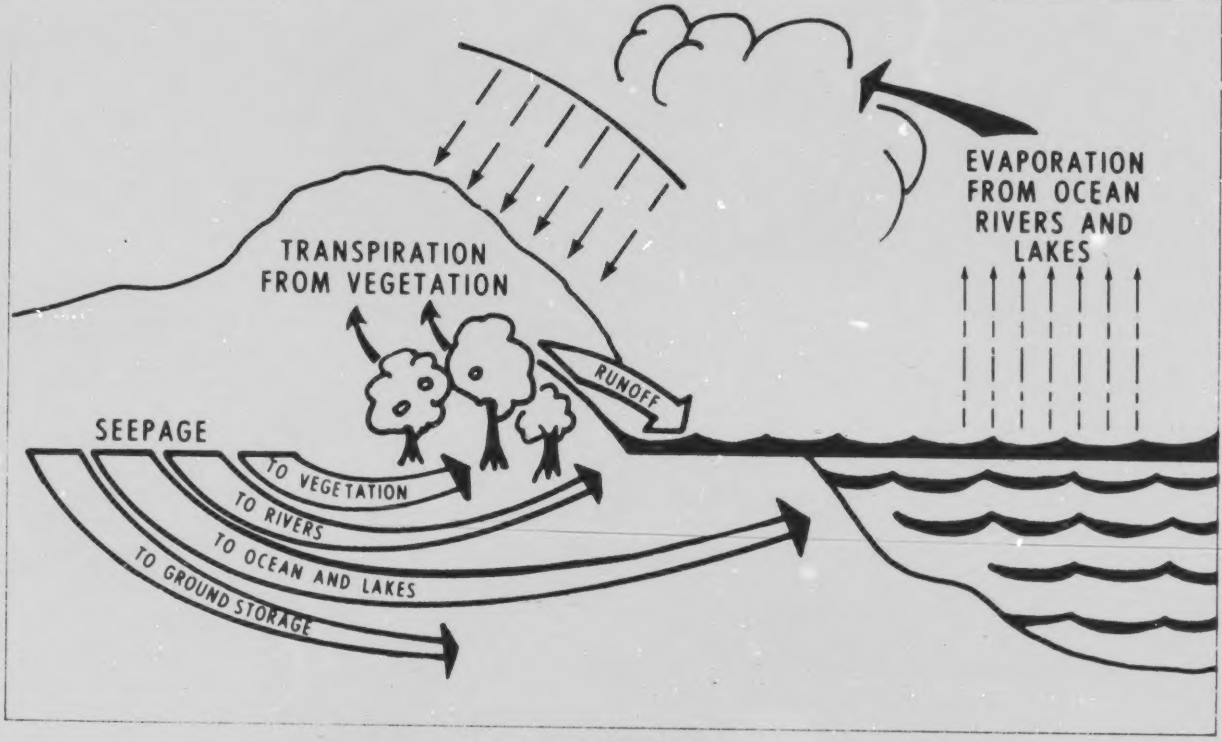

Figure 1.—Hydrologic cycle.

nitrate is found in water, it is difficult to determine if fertilizers are the source.

Furthermore, the overall nutrient requirements of algae and various aquatic plants are only partially understood. Because of the present lack of knowledge, we cannot state categorically that above-normal levels of nitrogen and phosphorus in waters will result, inevitably, in algae blooms.

A more obvious and direct danger is a high-nitrate content in drinking water. High-nitrate water, when consumed by babies, can change part of the hemoglobin to methemoglobin, a blood component that causes oxygen starvation. This disease, methemoglobinemia, is relatively rare in babies, and adults are seldom affected. The Public Health Service has set 10 parts per million as the maximum desirable limit for nitrate-nitrogen in drinking water.

VOCABULARY

anaerobic—able to grow in an oxygen-free atmosphere, deriving oxygen from nitrate compounds.

denitrification—the reduction of nitrate to nitrite, with the formation of ammonia and free nitrogen, as in nitrate reduction in soil by soil organisms, particularly anaerobic organisms under certain conditions.

effluent—liquid discharged as waste.

eutrophication—the process of becoming over-enriched in plant nutrients, either as a natural phase in the maturation of a body of water or artifically, as by fertilization.

leaching—the process of separating the soluble components from a material by percolation.

nitrification—oxidation by bacteria of ammonium salts to nitrite and further oxidation of nitrite to nitrate wherever the proper conditions of temperature, air, moisture, and alkalinity allow the nitrobacteria to act.

percolation—the slow passage of a liquid through a filtering medium.

titration—the volumetric determination of a constituent in a known volume of a solution by the slow addition of a reacting solution of known strength until the reaction is completed, as indicated by a color change (indicators).

transpiration—the emission or exhalation of watery vapor from the surfaces of leaves or other parts of plants.

NOTES:

ACTIVITY I: Nitrate Filtration

The following activity is based on an ARS pilot project in Phoenix, Arizona. In this project, the effluent from the city of Phoenix passes through a conventional sewage plant and is admitted into shallow basins (recharge basins) using a plant-soil filter system covering 1,000 acres. The effluent is purified as it percolates through the soil. When it reaches the ground water table, it moves laterally, as ground water, to a well or other collection facility.

Under the best conditions, one acre of this filter system could process 300 acre-feet or more of secondary sewage effluent per year. This amounts to approximately 100 billion gallons per year, or 270 million gallons per day. One of the major advantages of this process is its low cost. It is one-tenth the cost of chemical revitalization.

The following activity is a microversion of the project in Phoenix. You will learn how to construct your own soil-filter system to filter and purify water that contains nitrates.

For the system to work effectively, the soil must be saturated with the water passing through it. As the soil becomes saturated, anaerobic conditions result. Under these conditions, anaerobic bacteria use nitrate as a source of oxygen. The microorganisms metabolize the oxygen from the nitrate, causing the release of free nitrogen into the atmosphere. This process is called denitrification.

The technique explained on page 10 can be used to chemically analyze the water for nitrate content before and after filtration. Other methods of chemical and biological analysis can also be used.

NOTE: The material you use for filtering will vary in its capacity to remove nitrate. It will also vary in permeability. Consider these factors because they will affect your results. You can develop many variations of this activity by varying the length of the filter, the type of filtering material, etc.

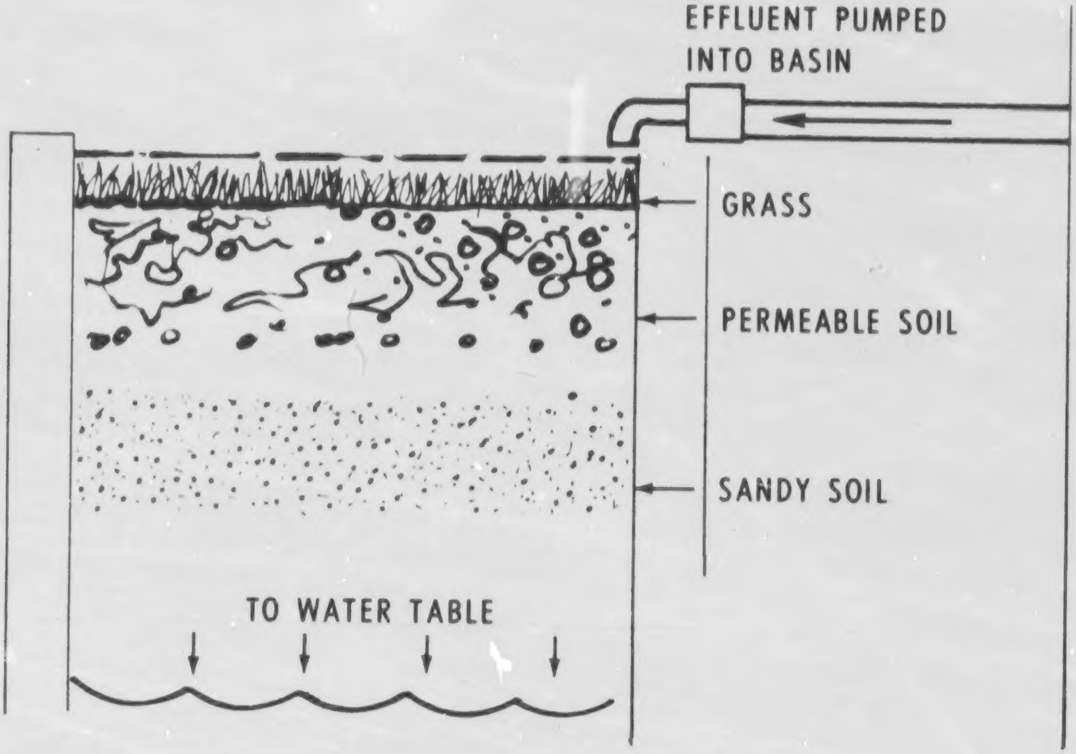

Figure 2.—Flushing Meadows Pilot Project.

Objective:

To measure nitrate present in water and to remove nitrate from water by denitrification during filtration.

Materials:

Two (or more, depending on number of samples of test water) plastic or glass columns approximately 3 feet long and 1-1/2 inches wide. The Earth Science Curriculum Project (ESCP) equipment may be used.
Distilled water.
Gravel, sand, soil.
Glass tubing—5 mm. outside diameter.
One-holed rubber stoppers—size # 8.
Erlenmeyer flasks 350 ml. (suggested size).
Beakers 400 ml. (suggested size).
Ring stands to support columns.
Test tube clamps to support columns.
NOTE: You will also need materials for the nitrate test, see page 10.

Procedure:

A. Setting up apparatus.
   1. Prepare two columns: one for the actual test and one for a control. Feed the glass tubing into the one-holed stoppers and fit each one into the base of each glass column.
   2. Feed a piece of cotton into each column, placing it at the base just above the stopper. Then fill each column with 1/3 gravel, 1/3 sand, and 1/3 soil, in that order from bottom to top. Leach out any nitrate, if necessary, by running water through the columns.

B. Water samples containing nitrate.
   1. Water that has leached well-fertilized soil.
   2. Any water containing decaying substances, such as raw sewage, dead leaves, etc.

C. Nitrate test.
   1. Test the water sample for nitrate. Refer to the nitrate test on page 10

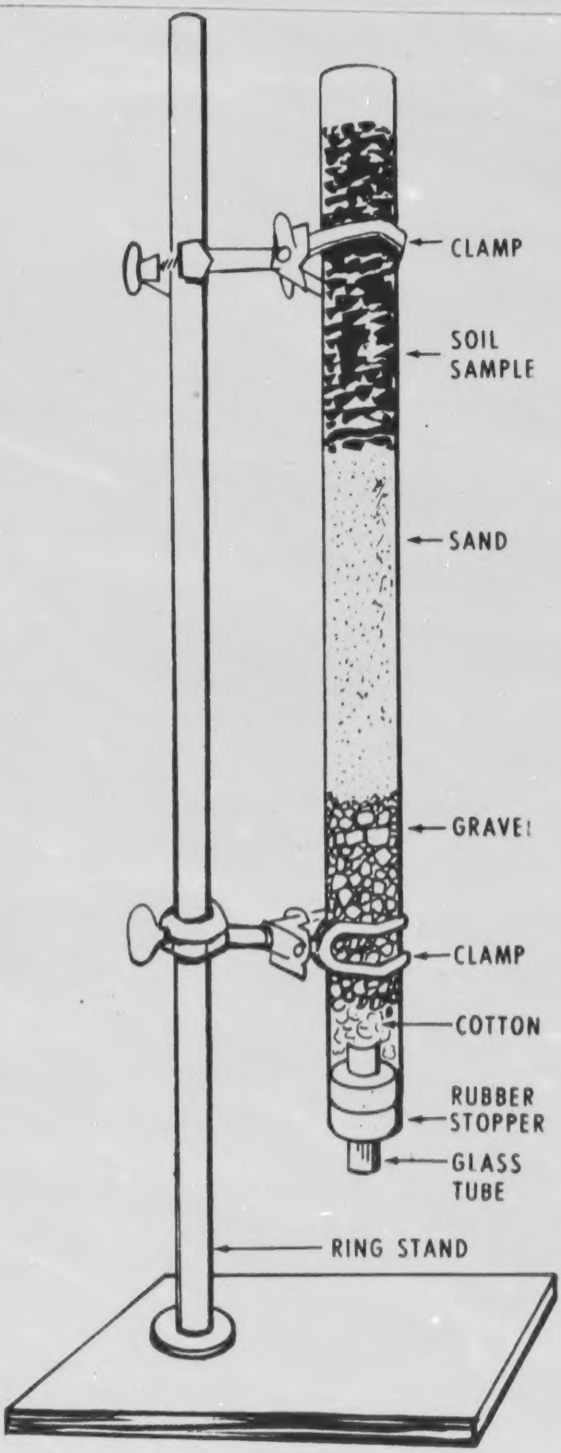

Figure 3.—Apparatus for nitrate filtration

2. Test the distilled water or tap water to be used as a control sample.

D. Filtration Process.

1. Pour into one glass column as much test water as it will hold; continue pouring the water (in order to saturate the column) until you have obtained the desired amount of filtrate. (Only 4 ml. are needed per test.)
2. Into the second glass column, pour distilled water or tap water and follow the same procedures as in =1 above.

E. Repeat the nitrate test on filtered samples.

Questions and Suggestions:

1. How effective do you think this technique is in removing nitrates?
2. What causes the nitrates to be removed by the soil?
3. What other pollutants might be removed by this technique? Try some other standard qualitative tests for chemicals, outlined in any standard high school chemistry book.
4. Devise a technique for sampling the water for microorganisms before and after filtration.
5. What are the differences between primary, secondary, and tertiary stages in the purification of water?

NOTES:

ACTIVITY II: Measuring Nitrate Used by Plants

In this activity, you will measure the amount of nitrate used by various plants. By using plants of different ages, you will discover at what stages of development plants require the maximum amount of nitrate.

The plants are grown in a nutrient nitrate solution, because it allows a direct quantitative measurement of nitrate using the Conway Method (see nitrate test on page 10). This method can be used to measure the ammonium (NH_4) content as well as the nitrate (NO_3) content.

Objective:

To measure and determine the amount of nitrate used by plants at different stages of development.

Materials:

Marking pencil.

Three corks of the size to fit the mouth of the jars you use. In the center of each cork, make a hole large enough to fit the stems of three plants.

Three jars. (More will be needed if you wish to test duplicate samples.)

Plant nutrient solution containing nitrate. Any commercial liquid fertilizer can be used. **Suggestion:** Follow the directions on the container when preparing the nutrient solution.

Three corn plants at each age: 1, 2, and 3 weeks. Other plants may be substituted for the corn plants.

NOTE: You will also need materials for the nitrate test, see page 10.

Procedure:

1. Fill each of the three jars to a level that covers the roots. Use the same amount of nitrate nutrient solution in each jar.

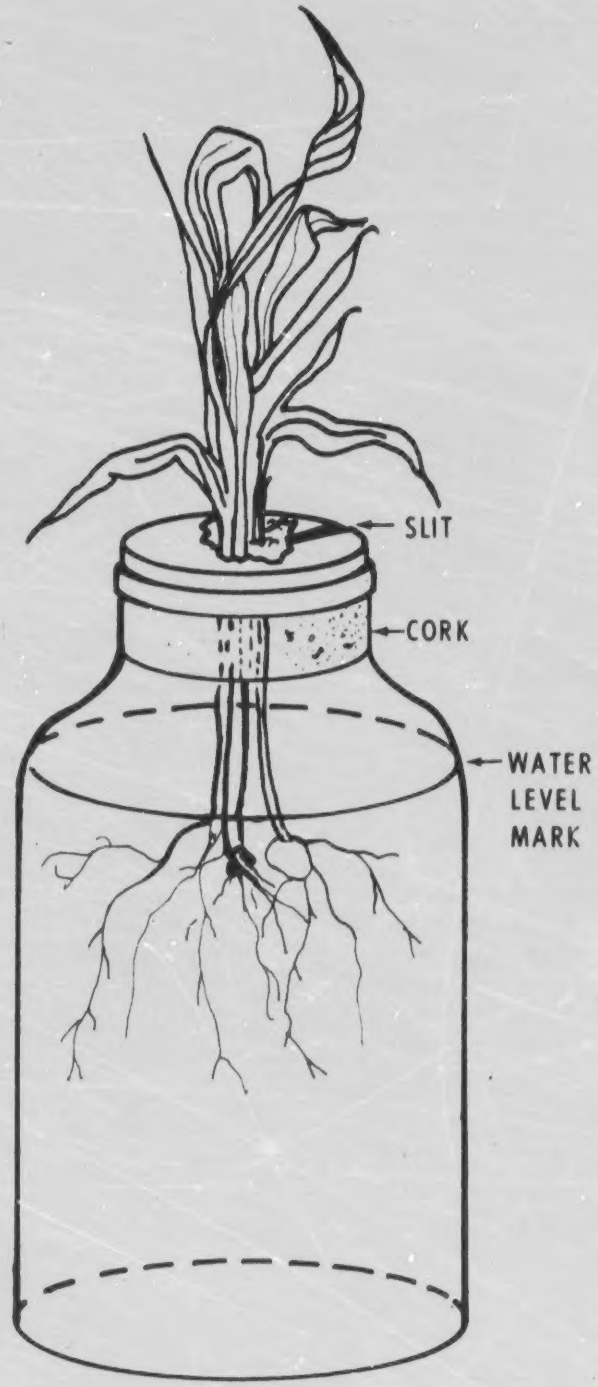

Figure 4.—Apparatus for measuring nitrate used by plants.

2. Test the NO_3 and NH_4 content of the solution using the Conway Method. Record the amounts detected.
3. Indicate the level of solution on each jar with a marker, and label the jars.
4. Insert the corn plants into each jar and through each cork. Use 3 plants of the same age for each jar. For easier insertion of plants into the center hole of the cork, make a slit in the cork from the edge to the center hole. After plants have been inserted, stuff cotton between the stems and cork to anchor the plants.
5. Aerate the nitrate nutrient solution 1 minute twice a day. Use an air line, water aspirator, or hold plants out of the solution and stir vigorously.
6. At the end of one day (24 hours), fill the containers up to the original marks with distilled water. This is necessary because there will be a loss of solution due to transpiration from plants. The volume of the liquid must remain constant to provide accurate quantitative results for the second nitrate analysis.
7. Test the solution for amounts of NO_3 and NH_4 present. The amounts lost will represent those used by the plants. The activity can be terminated at the end of one day or you can run the nitrate test again at the end of two or three days, depending on the time available.

Questions:

1. Is there a particular stage in the development of corn plants when the plant requires higher concentrations of nitrate? Explain.
2. Does the amount of water used by the plant in any way affect the amount of nitrate utilized? Explain.
3. How can the accumulation of nitrate in water sources be controlled by the grower if he has knowledge of the plant's need for nitrate?

Supplementary Activities:

1. It is suggested that the student try testing other kinds of plants. A comparison might be drawn between those plants which support nitrogen-fixing bacteria, such as bean plants, and those which depend instead on available nitrate in the soil.
2. Use two different concentrations of nitrate solution to determine whether the concentration of the nitrate present has any effect on the amount the plant utilizes.
3. Leave samples of distilled water and water with nitrate added in an exposed area to test for algae growth.

NOTES:

FOR ACTIVITIES I & II: A Nitrate Test (Conway Method)

There are many sophisticated techniques for determining the amount of nitrate in water. The Conway Method, described here, is a relatively simple procedure for a quantitative analysis for nitrate and ammonia.

(Note: If you do not have the necessary equipment for the Conway test, a less precise but simpler nitrate test can be made with a soil testing kit. These are available from most scientific supply companies.)

In this method, Devarda's alloy in an alkaline solution produces hydrogen, which transforms all nitrate in the sample water into ammonium $(NO_3^- + 5H_2 \rightarrow NH_4^+ + 3H_2O)$. This diffuses as a gas, ammonia, to react with an indicator solution. When titrating this solution back to its original color with a known strength sulfuric acid, you can determine by the amount of acid used how much nitrate was in the original water sample.

Materials:

Twelve, 68 millimeter, Obrink-Conway microdiffusion dishes and covers. Available from Bel-Art Products, Inc., Pequannock, N.J. 07440; Fisher Scientific Co. (local office); or Matheson Scientific Co. (local office).
One microburette with a 0.2 ml. capacity, calibrated to 0.2 microliters.
One 4 ml. pipette.
One 10 ml. pipette.
Several beakers.
Devarda's alloy (reagent grade).
H_3BO_3 (boric acid) reagent grade.
Methyl red.
Bromocresol green.
95% ethanol.
0.1 normal NaOH (sodium hydroxide).
0.02 normal H_2SO_4 (sulfuric acid).
40% K_2CO_3 (potassium carbonate).
Tergitol (for use in boric acid solution).
Wash bottle.

Preparation of Materials:

A. Mixing indicators.
   1. In an agate mortar, grind 0.066 g. of methyl red, then add 2 ml. of 0.1 normal NaOH. Transfer to a 100 ml. volumetric flask and dilute to 70 ml. with 95% ethanol.
   2. In an agate mortar, grind 0.033 g. of bromocresol green, then add 1 ml. of 0.1 normal NaOH. Add this to the methyl red solution and fill the flask to volume with water. This mixture is 0.033% bromocresol green and 0.066% methyl red.

B. Preparing 1% boric acid solution with indicators.

To a liter volumetric flask, add 10 g. of reagent grade H_3BO_3 crystals, 200 ml. of 95% ethanol, 700 ml. of water, 10 ml. of mixed indicator, and 0.25 ml. of tergitol. Stir until the H_3BO_3 is dissolved. Add water to the one-liter mark.

C. Preparing Devarda's alloy.

In a mortar, grind to a fine powder approximately 50g. of this reagent-grade alloy. This alloy acts as the reducing agent to convert the nitrate to ammonium. Approximately 30 mg. are used in each Conway dish.

Procedure:

1. Pipette 1 ml. of boric acid indicator solution into the center ring of each of the four Conway dishes (number 1, 2, 3, 4). Make sure that none of the substances from one ring get into other rings of the diffusion unit.
2. Using a fine spatula, distribute fairly evenly approximately 30 mg. of Devarda's alloy into the second ring of Dish #1.
3. Pipette 4 ml. of the solution to be analyzed into the second ring with Devarda's alloy.

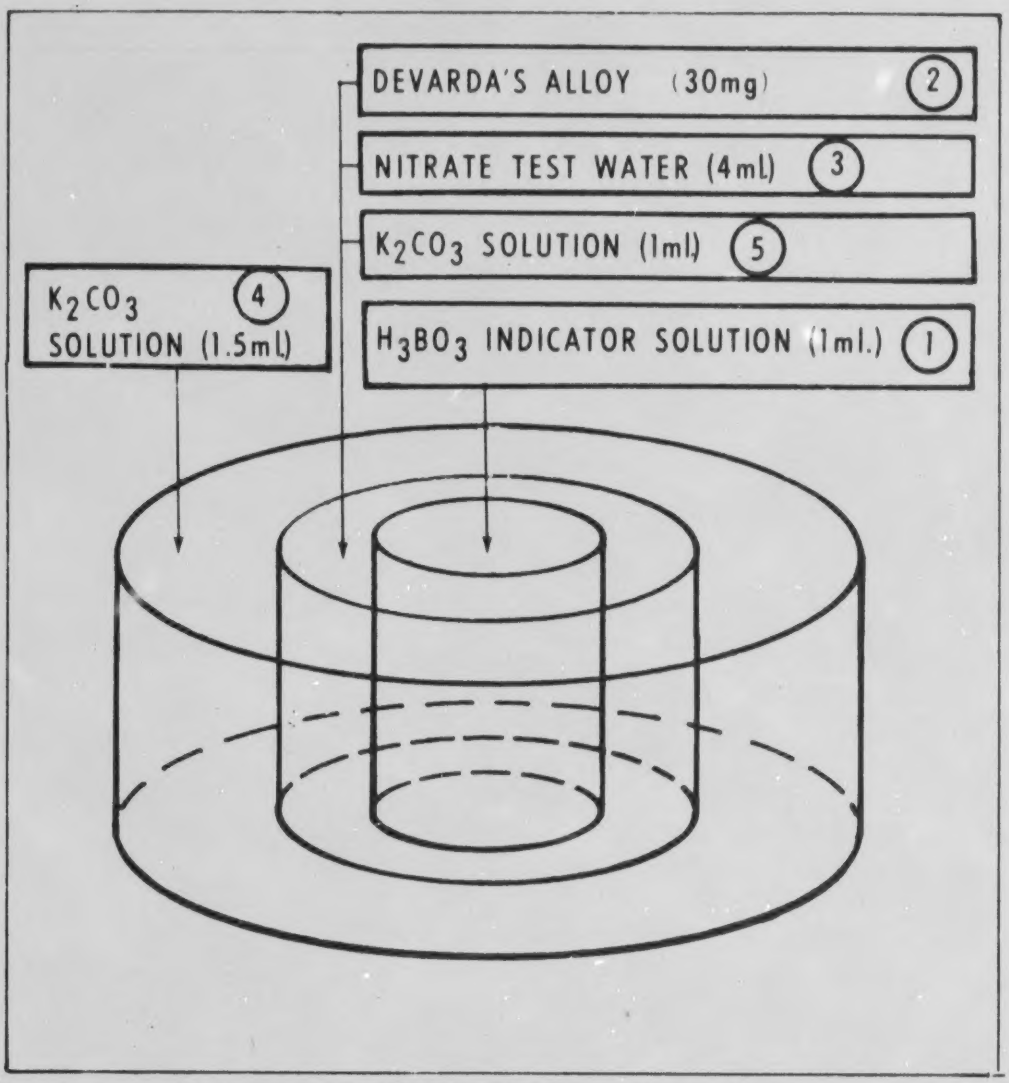
DEVARDA'S ALLOY (30mg) ②
NITRATE TEST WATER (4ml) ③
K_2CO_3 SOLUTION (1ml) ⑤
K_2CO_3 SOLUTION (1.5ml) ④
H_3BO_3 INDICATOR SOLUTION (1ml.) ①

Figure 5.—Conway dish for nitrate testing. (Circled numbers correspond to procedural steps, see opposite page.)

4. Pipette 1.5 ml. of 40% K_2CO_3 solution into the outer ring.
5. Pipette 1 ml. of 40% K_2CO_3 solution into the ring containing the Devarda's alloy and the sample test water. The K_2CO_3 acts as a sealing agent.
6. Prepare the second Conway dish in the same way as the first dish, omitting the Devarda's alloy.
7. Prepare the third and fourth Conway dishes as controls in order to check on the purity of the reagents. Both should contain distilled water in place of the sample test water. One should contain Devarda's alloy; the other should not. All other contents are the same as in Dish #1.
8. Place the lids on the four dishes and allow them to stand overnight.

Titration Procedure:

9. After twenty-four hours, remove the lids and place a small amount of distilled water into the center chamber of all dishes to provide more volume.
10. Fill the microburette with .02 normal H_2SO_4 (sulfuric acid) and begin titrating the solution contained in the center ring. Record the number of microliters of H_2SO_4 needed to return the indicator back to its original color. (Be sure to rinse off the burette with distilled water before using it each time.)
11. Calculate the amount of nitrate nitrogen in the original sample as follows: Total acid used minus acid used by control times 280 = micrograms nitrate nitrogen (in Dish #1). Note: 1 mililiter of .02 normal H_2SO_4 will titrate 280 micrograms of nitrogen in the form of ammonium.

Discussion of Control Procedure:

If the water sample already contains ammonium, this must be determined without Devarda's alloy (see Step 6 of Procedure). In such a case, the titration from Dish #2 is subtracted from Dish #1 to determine the amount of nitrate-nitrogen (see Step 11).

Suggested Uses for Techniques:

1. Analysis of Water Nitrate (e.g., in pollution studies). According to U.S. Department of Health Standards, only 10 p.p.m. nitrate nitrogen is permissible in drinking water.
2. Analysis of Soil Nitrate (also important in pollution studies). Excess nitrate in the soil can be a contributing factor to water pollution as a result of soil runoff and downward leaching through the soil.
3. Analysis of Plant Nitrate—A study of the amounts of nitrates absorbed by a plant or used by plants during different periods of development.

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Prepared by

Information Division
Agricultural Research Service

FACT SHEET

PRESIDENT'S ENVIRONMENTAL MERIT AWARDS PROGRAM

The President's Environmental Merit Awards Program will make it possible for students of the Nation's high schools to receive recognition for individual or group projects that benefit the environment. Opportunity to participate in the program is being offered to some 38,000 public and private high schools across the country.

All students who undertake and complete a responsible environmental service project will receive an award. Additional awards will be given to projects deserving special recognition. Panels made up of student, faculty and community representatives will administer the program. National support for this program will be provided through the Environmental Protection Agency and the Office of Education.

Suggested projects for the program could fit into four categories -- education, environmental awareness, community service and public affairs. Students could seek assistance with their projects from private as well as governmental agencies at all levels -- Federal, State and local. The best primary sources of help would be provided by local libraries and environmental groups.

Objective - To provide a vehicle through which the Federal Government may recognize and reward constructive, responsible environmental services performed by American high school youth throughout the country.

Scope - The President's Environmental Merit Awards will encompass youth activities throughout the entire country and will be offered through more than thirty eight thousand high schools, both public and private.

Structure - Environmental service awards will recognize two levels of accomplishment in the performance of environmental service. The first level will be granted to all students or student groups who undertake and complete a responsible environmental service project. The second level will be awarded for projects which are considered by a judging panel to merit special recognition for achievement.

Administration - The awards program will be administered at the local level, using judging and advisory panels made up of student, faculty and community representatives. This method of administration is considered essential because evaluation of projects should be made using community needs and problems to determine the criteria.

Participation - Students may take part as individuals or as members of school organizations. They can choose a more passive role concerned in a general education - type project or play a more active role by becoming involved in a project concerned with governmental process.

Categories of Concern - Individual or group activities could be undertaken under a number of objectives such as:

Education - Possible activities could be to conduct pollution surveys, to gather watershed analysis data, to develop inventories of consumer habits or to study government and legislative processes.

Environmental Awareness - This category would carry the education process one step further by giving presentations at community meetings, preparing articles for local newspapers, sponsoring ecology fairs and working with younger children.

Community Service - Suggested projects could include restoring streams to their natural state, eliminating vermin, cleaning up litter, landscaping a park, staffing an environmental information center or operating a recycling program.

Public Affairs - Direct involvement in government at work could include cooperating with public officials, attending public hearings, presenting environmental data to zoning boards, sewage districts planning authorities and utility commissions.

Support - Private as well as governmental agencies at all levels -- federal, state, and local offer a wide variety of assistance to projects. While capable of supplying general information needs, large agencies are best utilized once specific program objectives have been determined. Local libraries and environmental groups are the primary source of information during initial project development.

# # #

If you are interested in enrolling your school in the Environmental Merit Awards Program write a letter of intent to:

National Coordinator
President's Environmental Merit Awards Program
Environmental Protection Agency
Washington, D. C. 20460

Be sure to include:

Name of the school
Complete address
School enrollment
Principal
Faculty Adviser or other school contact
Telephone

When your enrollment is received, you will be sent the program materials and placed on a mailing list for future information.

THINGS TO KNOW

I do not own an inch of land,
But all I see is mine.
Alice Cary

SOIL AND LAND*

* *Definition: Soil is the surface layer of mineral particles and organic matter. Land is the surface in a special sense.*

Here are some things to know and remember about Soil and Land.

Soil is formed from rocks by geological erosion.

Soil is formed continuously over a long period of time by natural forces.

Soil is formed in layers that differ in texture, organic content, structure, water-holding capacity and fertility.

Soil is a reservoir that holds water.

Physical, chemical and biological processes make plant nutrients in the soil.

Soil is eroded by wind and water.

The erosibility of soil is determined by texture, slope, moisture content, and cover.

The soil is held in place by trees, shrubs, grasses and other plants.

Good agricultural land is taken out of production for man's other needs.

Irrigation, drainage and forest removal bring new lands into agricultural production.

Man both accelerates and retards the erosion of the soil.

Man both destroys and builds up fertility in the soil.

The welfare of people is affected by the way the land is used.

The characteristics of each acre of land may be different and they influence what its use should be and what protection it needs.

When man learns to manage the soil correctly, it can be passed to future generations unharmed or improved.

Soil, water, wildlife and vegetation are interdependent and all are essential to the well-being of man.

Man uses zoning and planning methods to define and adjust to proper land use.

Control of erosion is more effective when landowners work together.

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* Reproduced by permission of Camp Fire Girls, Inc. from the the publication "Conservation".

Water is the prodigal
of hydrogen and oxygen
Ever wandering, moving on.
Anonymous

WATER

Definition: Water is the liquid which descends from the clouds in rain, hail and snow, and which forms streams, rivers, lakes and oceans.

Here are some things to know and remember about Water.

Water can change in form with relative ease, but is never destroyed.

Water supply is often not sufficient to meet the demand for water.

Water responds to gravity.

Water is not easily moved from its source for use in a different locale.

Water is a fugitive resource.

Water is variable in quality.

Through the process of evaporation and precipitation water returns to us.

The distribution and supply of water influenced where man wandered and settled.

Water is essential to living things.

Soil, plant and animal life are interrelated with water.

The availability of water and the uses to which it may be put vary with the locality.

The supply and availability of water at any given point are variable and may become uncertain.

Quantity and quality of water determine how man shall use it.

Property rights to the ownership and use of water have unusual characteristics and are different in various sections of our country.

Better use of water requires planning.

Conflict over water use produces competition for its use.

Water that is properly managed can give varied and repeated services:

To produce energy ● provide recreation ● transport waste ● meet domestic and municipal needs ● grow food ● process food ● supply manufacturers increased demands ● facilitate increasing navigation and transportation

. . . move along these gentle shades
In gentleness of heart; with gentle hand
Touch — for there is a spirit in the woods.
Wordsworth

FORESTS

Definition: Forests consist of trees and other plants; cover a large area: use soil nutrients, water and sunlight to reproduce.

Here are some things to know and remember about Forests.

Plants are the only organisms that convert the energy of the sun into food energy.

Plants and animals fertilize the soil on which they grow; they also help deplete the soil.

Every plant and animal has a function in the forest community.

Plants provide food, fuel, fiber and protection.

Insects and fungi can be beneficial or harmful to the forest.

Plants retard quick-drying of the soil by winds and rapid run-off after rainfall.

Some land produces its greatest economic and social benefits when used for forest production.

Properly managed forests can produce continuously.

Aesthetic appreciation of birds, trees, wild flowers and animal life is an important value to many people.

Ownership of forest areas, whether public or private, carries an obligation for good citizenship.

The wild hawk to the windswept sky
The deer to the wholesome wold. . . .
Rudyard Kipling

WILDLIFE

Definition: Wildlife consists of game and fur animals, game and song birds, fish and miscellaneous animal life.

Here are some things to know and remember about Wildlife.

Wildlife is the one natural resource that belongs to all people no matter where it is found.

Access to wildlife implies responsibility to adhere to regulations that protect wildlife and people.

Food, water and cover are necessary to wildlife every day the year through.

The carrying capacity of the land for a species is dependent on the availability and distribution of food, water, cover and space.

Some species of wildlife destroy poultry and livestock, crops, the eggs and young of game and waterfowl.

Predators perform useful services in killing diseased or crippled animals, in eating insects and rodents.

Certain species are in danger of extinction.

Wildlife is a product of the land.

Without taking any land out of profitable crops, almost every farm has acres that wildlife can utilize.

Land that is drained for agriculture, industry or residence interferes with fish and fowl populations.

Conflicts in the use of wildlife can be resolved by cooperation and mutual planning.

Management practices based on comprehensive research allow wildlife to be harvested as a crop perpetually.

Gold is precious; iron ore is priceless.
Andrew Carnegie

MINERALS

Definition: Minerals consist of the metals, mineral fuels, lubricants, ornamental and building stones, sands and clays.

Here are some things to know and remember about Minerals.

Minerals cannot be maintained and used except in the limited sense of the use of certain long-lasting mineral products or of processing steps that require minerals and do not alter their quality or quantity.

Mineral fuels and lubricants are destroyed in use.

The other non-metal minerals are plentiful.

The parent material of the soil is mineral.

The mineral content of the soil is a factor in the growth and health of living things.

Food varies in nutrients according to the soil upon which the plants and animals were raised.

Ways of life influence demands for minerals.

No one country is sufficient to itself in mineral resources.

A nation's industrial potential is determined by its mineral resources.

Understanding of the origin of minerals is necessary if they are to be found and developed.

Available minerals should be substituted for less available minerals wherever economical.

Saving scrap metals and re-using supplies above ground will make it less imperative to mine new ores.

Good mining methods make the supply last longer.

A man said to the universe
"Sir, I exist."
"However," replied the universe
"That fact has not created in me
A sense of obligation."
Stephen Crane

HUMAN RESOURCES

Definition: Human resources are those services that are possible for man to give as he develops his physical, spiritual, moral and intellectual powers.

Here are some things to know and remember about Human Resources.

Human resources are often wasted in the same sense as the other resources are wasted.

Man has used his powers in ways that did not accrue to the benefit of mankind.

Job opportunity in a community frequently depends on the intelligent use of other natural resources.

Everyone has an ability that should be developed for himself and for society.

Every individual has a place to fill in his community and an obligation to work for community improvement.

Every person has a right to an educated, healthy, wholesome community.

Sample Lesson Plans

ENVIRONMENTAL EDUCATION THROUGH LANGUAGE ARTS

(Bob Roth, Montgomery County Public School System)

OBJECTIVE: To gain further understanding of the role of language arts in our lives.
To develop an awareness of the natural environment.
To extend and apply the students' knowledge of language skills.
To develop perception and observation.

I. Select three objects from a natural area.
  A. Apply a name to the objects (noun -- name of person, place, things, or quality.)
  B. Describe each object in one word (adjective -- modifier of nouns)
  C. What is it doing, what did it do, what can it do? (verb -- action or state of being)
  D. How can it do something? (adverb -- modifier of verbs, adverbs, adjectives)
  E. Add an article, a conjunction, and a pronoun to finish a sentence you have now begun.
    1. Article
    2. Conjunction -- connects words, phrases, or clauses
    3. Pronoun -- takes place of noun

II. Now compose a sentence using your information about the three natural objects:
  A. Example: Noun - stone
    Adjective - yellow
    Verb - rolled
    Adverb - rapidly
    Preposition - down

  The yellow stone rolled rapidly down the stream bed while water surged all around.

III. Sentence types -- Write a sentence about each object using the following forms:
  A. Declarative - a statement.
  B. Interrogative - a question
  C. Imperative - a command
  D. Exclamatory - surprise or excitement

IV. Creativity
  A. From your observations of a portion of the natural environment, write your feelings about it.
    1. Your writing may take the form of
      a. Poetry
      b. Essay
      c. Short Story
        1. Fiction
        2. Report
    2. You may wish to include
      a. Analogies -- familiar terms to describe unfamiliar ones
      b. Comparisons -- estimation of similarities and differences
      c. Similes -- one thing is likened to another

V. Evaluation
  A. What vocabulary gains have you noticed?
  B. What forms of writing were effectively used?
  C. How can you expand this experience into usable learning activities?

ENVIRONMENTAL EDUCATION THROUGH CREATIVE WRITING

(Bob Christie, Montgomery County Public School System)

The out-of-doors provides many opportunities for creative writing as well as report writing, note taking, and other forms of language arts experiences. To capitalize on the opportunities afforded by the environment, good planning is vital to satisfactory experiences. If children are going to write, they should be involved in a series of experiences that will help them become aware of topics and should plan toward their writing efforts.

One of the ingredients in improving writing skills is the broadening of vocabulary. Combined with this can be some activities that help students develop an attitude while working on some of the necessary skills.

Such lead-up experiences might include some of the following:

1. Sensory exploration of natural phenomena

   (a) Close eyes and touch bark, leaves, feather, rock, etc. Describe what the object feels like. Let several persons use descriptive terms to tell what the object feels like. Such a process may be followed using the other senses.

   (b) Games can be played by doing such things as trying to describe objects using similes, metaphors, or comparisons.

   (c) Make up short rhyming descriptions, list as many terms as possible that describe a phenomenom.

2. Use environment to set a mood. Look out over a vast expanse. Look up through the trees to see the patterns of leaves and "daylight" (or darkness and stars at night), examine a hole in the ground or in a tree.

   (a) Ask for short verbal reactions to both common and uncommon objectives and surroundings. (You may also use some of the exercises from 1-a.)

   (b) Select poetry and stories that are appropriate for the physical environment in which you are working with children. Go into a wooded area when reading poetry about trees, forests, etc. This helps children visualize what the author is writing about in addition to giving the children ideas about topics which they may want to write. Compare different writing styles and descriptive terms.

(c) Concentrate on a series of short phrases before getting into writing stories -- Haiku poetry is a good introduction to the writing of poetry for the intermediate grades, or writing verses to songs telling about their experiences (to such tunes as "Hey Lolly, Lolly").

(d) Brief accurate recording of data describing phenomena is another technique that has carryover value into creative writing. Get students to focus on some of the smaller and less obvious objects, or search for unusual phenomena.

These are but a few of the kinds of things that can be done with children in writing. Stories, newspaper articles, letters and other forms of writing can be accomplished after an experience, but the quality of writing depends upon the conscious associations and understandings gained during the outdoor experiences. Good writing is not left to chance.

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ENVIRONMENTAL EDUCATION THROUGH PLANNING AND MANAGEMENT

(Developed by the National Park Service
in Cooperation with the Alamogordo Public Schools)

CONCEPT: Environmental planning and management involve the application of knowledge from many different disciplines.

BACKGROUND INFORMATION

Garton Lake, a National Environmental Study Area (NESA), is used for recreation and for environmental study. This is a planning exercise to involve the students in determining if there should be more recreational facilities and how they could be developed. In planning for recreational development, strong consideration must be given to the effect on the natural environment and use of the area as an environmental study area. Environmental planning projects begin with the selection of specialists from the disciplines needed. This project will require the services of ecologists, engineers, geologists, recreation planners, and economists. The class should be divided into planning teams with each team representing one of these disciplines. Each team should have a captain.

OBJECTIVE: To introduce the student to environmental planning through involvement in a practice planning exercise.

To help the student understand the necessity of employing a diversity of knowledge and skill in the planning process.

NESA: Garton Lake SUBJECT: Social Science, Math, Science

STUDENT ACTIVITIES

Geologists - Make a map of the area showing topographic and other geologic features.

Ecologists - Make a map of the area showing type and distribution of plants and animals. Emphasize what features should be preserved.

Recreation - Planner - Make a map of existing recreational facilities, picnic tables, etc., and determine what type of additional facilities are needed.

Engineer - Make up a map showing existing roads and determine type of additional roads, parking areas, and utilities needed.

Economists - Determine the costs involved including recreation equipment, materials, etc.

ALL DISCIPLINES

When all of the information has been gathered, the teams should come together for a general planning session. Here is where the differences of opinion on how the area should be developed, should be resolved. The end product of this meeting will be a map showing the existing features of the area, and proposed developments, if any.

STUDENT DISCUSSION

If the planning had been left to one individual, such as a geologist, what would the final map have looked like? How about if it had been left to the engineer, the recreational planner, the ecologist?

How would use of the area as an NESA be affected by additional recreation developments? Are recreation and environmental study compatible uses?

Why is it necessary to apply this concept of planning for development of other environments such as urban neighborhoods, city centers, shopping centers, highways, roads, etc. ?

ENVIRONMENTAL EDUCATION THROUGH ART

Roy Graybill and Sandra Walter

Bark Pattern Rubbings

Rub the side of a fat dark crayon on a piece of tracing paper held firmly on/around the trunk of a tree. This will show you the pattern of the bark. Make bark rubbings of several kinds of trees. Exchange the rubbings and try to match these with the trees from which they were made.

Nature's Materials

On heavy paper and using only natural materials, sketch a picture of an object on the school site. Grasses, leaves, charcoal, dandelions, and red bark from rotted stumps can be used for colors.

Soil Painting

Purpose of activity: To help children understand that there are many types and colors of soils, depending upon depth, location, etc.

A. Materials
  1. **Main soils and sand of as many colors as possible, collected from around the school site**
  2. **Baggies to hold the soil**
  3. White glue
  4. Container for glue mixture
  5. Two brushes, 1/2 inch and 1 inch
  6. Wood or cardboard (Consider the weight of the piece of wood since you may wish to frame and hang your final result.)

B. Preparation
  1. Gathering soils
     a. Where? On or near school site? Emphasize necessity of gathering many different types and colors. Ask children to carefully note where each type was found. Discuss.
     b. What?
        (1) Sands
        (2) Garden soil
        (3) Peat
        (4) Clay
        (5) Crumbled rock
  2. Preparing the glue
     a. Fill a jar or glass half full of white glue.
     b. Add enough water to fill the container.
     c. Keep some glue in the original container at full strength.
  3. Planning
     a. Plan scene, design, or picture.
     b. Sketch plan on cardboard or wood.

C. Soil Painting
  1. Use a paint brush, stroke on the glue solution where you want one type of soil.
  2. Sprinkle on soil.
  3. Brush glue on another area of picture, not adjacent to the drying area.
  4. Continue until the scene is complete.
  5. Suggestions
     a. For blending colors, work beside each other when glue is wet.
     b. For sharp color distinctions, wait for drying.
     c. For sharp and narrow lines, apply glue in full strength directly from bottle, sprinkle soil, and shake off excess immediately.

d. For any raised line, apply glue in full strength directly.
e. For a heavy raised object, mix your soil with plaster of paris and apply immediately. Mix a small amount with a great deal of soil in it because it dries lighter than it goes on.

D. Preserving
  1. When the soil is completely dried, stand the picture on a side and the loose particles will fall off.
  2. Repair any areas that need it.
  3. Spray with plastic.
  4. Frame if you wish.

ENVIRONMENTAL EDUCATION THROUGH DESCRIPTIVE WRITING

(Orville Jones, Montgomery County Public School System)

Directions: Find the objects listed below and then do the following things:
  (1) Look at the object.
  (2) Feel the object.
  (3) Smell the object.
  (4) Listen for sounds which may come from it (or are associated with it).
  (5) Taste it (if it is safe to do so).

In the space provided after each object, write as many descriptive words about the object as you can using your sensory experiences as the basis for description. Further, describe in writing the area where you found the object.

1. This year's deciduous leaf -
2. This year's evergreen leaf -
3. Last year's deciduous leaf -
4. River Water -
5. Water from a spring -
6. Wet soil or mud along the river -
7. A rock -
8. Twig on a tree -
9. A flower -
10. Bark on a tree -

ENVIRONMENTAL EDUCATION THROUGH SCIENCE

(Elementary Environmental Studies Curriculum Committee,
Vancouver Public Schools, District No. 37)

THE "DANDY LYIN" IN THE SIDEWALK CRACK

Understanding: A dandelion, a typical plant, is adapted for successful life in its surroundings.

Rationale: The common dandelion can be used for a most fascinating study of adaptations for survival. The abundance of this plant and its long growing season make it an ideal plant for children to study. They will be surprised to learn that one dandelion is really a "bouquet" of flowers.

Objectives: When the student has completed this lesson, he should be able to perform the following tasks:

1. To point out on a diagram (young students) or to label on a diagram (elder students) the following parts of a dandelion: flower cluster, single flower, stigma, bracts, root, stem, and leaf.

2. To draw and tell (young children) or to write an explanation (older students) of how the dandelion has adapted for these things: food storage, absorption of sunlight, cross-pollinization, protection from enemies, and insurance of survival of some of its young.

3. To apply what he knows about dandelion parts and adaptations in making generalizations, based on direct observations, about other flowering plants.

Instructional Procedures -- Resources:

1. Roots are strong and well-stored for food.

   a. Try to pull plant up. The root anchors it in place.

   b. Dig root out and note fleshy root somewhat like a carrot or parsnip. Food is stored in the root. It is this stored food that the plant uses to get such an early start in the spring. Often it blooms in the winter if in a sheltered spot. Dandelions seem determined to get their young established before the competition with other plants becomes keen.

2. Leaves cuddle together for warmth -- they are arranged to get plenty of needed sunshine for growth.

   a. Observe how leaves are arranged. They appear in a rosette, lying close to the ground. Thus they prevent loss of heat and keep warm enough to do their work even when the air is so chilly most other plants are inactive.

b. Observe how the leaves are shaped to obtain ample sunlight. They appear to spring from the top of the root, but really begin from a very short stem. They radiate from this point so their tips form a circle. Broad leaves in such an arrangement would overlap and cut each other off from essential sunlight. The dandelion leaves are narrowly shaped wedges, tapering toward the stem. Even so they would get in each other's way if the margins of the leaves were not cut deeply into jagged lobes. In this way light gets down between the upper leaves to the lower ones. The lobes have an outline somewhat like that of the teeth on a lion's jaw, hence the French name dent de lion, the tooth of a lion.

3. In sunshiny weather the dandelion holds its matured blossoms high and "advertises" for insect visitors to insure cross-pollination.

   a. Break apart a dandelion blossom and remove the smallest strap. This is one complete flower. What you first picked was really a dandelion cluster.

   b. Find these parts:

      1. Test your eyesight -- how many "teeth" are there on the end of the strap? This number indicates how many petals the ancestral dandelion had.

      2. Find the two "horns" at the top of the flower. These are the stigmas which catch the pollen brought from other dandelion clusters by insects.

      3. Just below the stigmas is a collar of stamens. Use a hand lens to count them. There are ten. Touch the stamens with your fingers and you'll discover where the insects get their pollen.

      4. Examine the green things on the outside of the blossom. These are called bracts.

      The heads, while the blossoms are maturing, lie hidden in the grass -- each at the end of its hollow stalk. Then some sunny morning, each head is carried up as its stem is erected, the protecting bracts curl back and the dandelion cluster advertises for insect visitors. Let clouds come and threaten rain, and the clusters close up again and are carried by the movements of the stems down into the protection of the grass. The pollen might be washed off by the pelting rain. Besides, insects are not visiting, but are themselves hiding from the shower.

      After pollination has been accomplished and the fruits are forming, the cluster closes, resumes its recumbent position, and remains close to the ground until the fruits are mature. Then it rises again, the bracts curl back, and the cluster of fruits appear as the familiar blowball.

   c. Single out several plants to observe through this period of development.

   d. Use a camera to record these events and display photographs on a bulletin board.

4. The bitter taste of a dandelion protects it from being eaten by browsing animals and insects.

   Besides the bitter taste, the sticky, milky juice gums up the jaws of such creatures.

   Make some rubber: Place some of the milk from the foot on your thumb. The milk is called lactic acid and is like the lactic secretion from the rubber tree. Now, rub the sticky lactic acid with your forefinger and you will soon have some black rubber that is elastic.

5. A dandelion's stem is strong and capable of varied movements.

   Pick a stem, split it slightly at one end, and continue to split it as the several portions curl tightly. The long fibers to the stem that strengthen it would all curl up if each one were not opposed by its opposite fellow. The stem is thus braced by these paired springs. With a minimum of weight and hollow so as to conserve building material, a dandelion's stem is strong, yet capable of considerable movement.

6. Each dandelion fruit has a "balloon" for sailing and a "grappling hook" for fastening itself where it can grow -- wide dispersal is thus insured.

   a. Take the oldest seed you can find. Let it float in the air. Which part of the parachute hits the ground first? Nature knows how to plant seeds!

   b. Examine another seed. Which end has hooks? Look again. Which way do these hooks point? How would this help insure the "planting" of the seed?

   c. Why are there so many seeds in one cluster? Who might feed upon them? What are the dandelion's competitors? Will all seeds land on a site suitable for growth?

Competency Measure:

Plan a bulletin board of photographs, drawings, and diagrams telling the story of the growth and development of a dandelion.

Plan a time for conducting a review as indicated in Objectives 1 and 2.

Locate other flowering plants on or near the school site. Have children identify plant parts and investigate their adaptations for survival. By referring often to what they already know about the dandelion, the teacher can guide their discoveries.

ENVIRONMENTAL EDUCATION THROUGH OUTDOOR ACTIVITIES AND LANGUAGE ARTS

(Montgomery County Public School System)

Creative Writing

- Composing stories about stars
- Writing the "adventures" of an object (where it came from, how it got there)
- Writing about the luck of an object
- Inventing legends and myths
- Writing tall tales
- Relating an experience in ballad form
- Writing poems, songs, newspaper articles

Writing letters home.

Planning the weekly outdoor program.

Planning the outdoor experiences from the classroom.

Keeping field notes, recording observations.

Using library for research reading.

Enjoying a good book in free time.

Labeling and identifying specimens.

Entering verbal discussions.

Writing menus.

Writing logs or diaries.

Telling stories.

Reading stories to the group.

Listening to various bird songs and recording the sound in schematic diagrams.

Reading about the local history of the area after becoming acquainted first-hand with places, people, and events of historical interest.

Making a list of all the outdoor sounds heard during an outdoor experience -- weave into a story (example: Bird - whistle; squirrel - ch ch ch; etc.).

Keeping a card file of outdoor terms - define and alphabetize for further use.

Listing and classifying descriptive words to describe one object by color, size, shape, texture, etc.

Listing adjectives to describe things to be seen, heard, smelled, felt, tasted.
-- Use as a basis for discovering things. Combine list and discuss with children.

Writing words in sand, snow, moist earth for better "feel" of the word.

Recognizing and recording new words after a field experience - make a class notebook or individual notebooks.

Collecting writings from the children on various outdoor experiences and assembling into a notebook for the library.

Commenting on the progress another child has made. Good guidance if the teacher would see that the evaluated child received his evaluation. Could be self-evaluation.

Games

- Matching a leaf to a tree in the area
- Composing counting rhymes
- Composing rope-skipping rhymes
- Information clues
  Example: We're thinking of 4-legged animals; it's a farm animal; and so on, becoming more specific
- Game of categories

Children choose animal, bird, tree, etc.; one tells class of the object that he chose; others try to guess name of object by asking questions that can be answered by yes or no; if answer is no, go on to other group; if answer is don't know, the group must tell what the object was.

SOME "AROUND THE SCHOOL YARD" ACTIVITIES

by

Char McDonald and Zee Butler, U. S. Forest Service, Portland, Oregon

USING THE SENSES

Equipment Needed:

1 sheet of manila drawing paper (8 1/2 x 11") per child.
Each child brings one dark crayon (green, black, brown, etc.).
Each adult leader should have a clip-board and paper and pencil.
List as many of the children's comments as possible for each activity.

Tell the children you are writing down their descriptions.

At intervals throughout the activity, read back their comments to them.

At the end of each activity, read what was said as a summary.

Group leaders should give the comments and descriptions to the teachers at the end of the field trip for use back at school to make experience charts and story-writing.

"Sound" Hike - (10 to 15 minutes)

Group leader takes kids for walk.

Stop at intervals along the way. Have kids close eyes and listen for 30 seconds. At end of 30 seconds, kids describe a sound they heard.

(Group leader should write down the way each kid described this sound.)

Try to stop in different places so there will be a variety of sounds to be heard.

See how many different sounds your group can discover.

Ask: Which sound did you like best?
Why?
Does it remind you of something else?
Which sound is the loudest? The quietest? The highest? The lowest?

Mini-Forest - (Approximately 15 minutes)
(Investigating an Arm-Circle of Grass)

1. Lie on the ground, face down.
2. Make a circle by stretching your arms out in front of you on the ground.

3. Find at least five different plants inside that circle made with your arms.
4. See if you can find any tiny animals crawling through the grass.
5. What else do you see? (Any dead leaves or twigs?)
6. Spread the grass apart and describe what you see.

Big Idea - Many plants and animals live together in a community.

Sketching - (15 to 20 minutes)

Find two trees with different shapes. Observe and sketch one tree at a time.

1. Look at the tree from a distance.
2. With your finger, "trace" (in the air) the shape of the tree. (Do this from the ground up to top and from top down to ground.)
3. Describe the shape of the tree.
4. Make a "telescope" with your hands. Look through this "telescope" at your tree from a distance.
5. Describe how the branches go out from the trunk. (Up? Out? Down?)
6. Hold out your arms to show how the branches grow out from the tree trunk.
7. Go closer to the tree. What else do you notice about it?
8. Get close to the trunk of the tree. Look up into the tree. What do you see?
9. Go to a comfortable place where you can see your tree. Sketch it with the crayon you brought.
10. Repeat procedure for second tree.

Add some of nature's color to your sketch.

Pick some grass. Use it as a crayon. Rub it around on the paper to show where the green is on your tree.

Pick a yellow dandelion blossom. Use it as a crayon somewhere on your sketch.

"Touch and Feel" Hike - (Approximately 10 to 15 minutes)

Group leader takes kids for a walk. Gives following directions at intervals along the walk. (Add others when appropriate.)

1. Find the hairiest leaf around. Bring back a tiny bit of it. Compare with your other group members.
2. Find the softest leaf.
3. Find the smoothest rock.
4. Find the roughest twig.
5. Find something cool.
6. Find something warm.
7. Find something bumpy.
8. Find something dry.

"Color" Hike

1. Look for things that are different colors of green. Bring back 3 or 4 green things. Arrange them in your hand according to lightest green to darkest green.

2. Find and describe things that are: yellow-pink-brown-grey.

MATH MEASUREMENT

Determine length of step. Use this unit of measurement for:

Calculate perimeters and areas of schoolyard activity spaces (playfield, ball diamonds, open fields, etc.). Convert measurements to yards, meters.

Construct a conversion scale for metric measurements using the length of your step.

Find out how many times you need to run around the playfield to run a mile.

Find out how many acres are on your playfield.

Construct a map of the schoolyard using the plane table method.
Map to scale.
(Use Boy Scout Merit Badge Series on Surveying as a reference.)

Determine heights of trees, utility poles on or adjacent to schoolyards, using triangulation and a stick at least as long as your arm.

Compute cubic volume of trees and utility poles using above method.

Determine percentages of slope of land using a yardstick, another stick, a baby food jar half filled with water.

Construct a topographic model of your schoolyard using layers of cardboard.

Learn to use compass and determine cardinal directions on schoolyard. Orient map and compass to actual landscape from schoolyard.

Learn to use instant mapper and use it with the compass.

Observe and sketch geometric shapes seen on schoolyard or adjacent areas. (Find triangles, circles, rectangles, squares, lines, etc.)

THINGS TO DO WITH TREES

Observe and compare the shapes of trees.

How many shapes can you find?
Discuss the shapes. Is it triangular? Like a column? Evenly tapered? Low and spreading? Regular? Irregular?
Find two trees with distinctly different shapes and sketch them.
Look for different shapes of trees on the horizon.

Observe and compare the branching of trees.

How many different directions do trees branch?
How do the branches grow out from the tree? Straight out? Out and then down? Out and

then up at the ends?
Find two trees whose branches grow differently and sketch just the way the branches grow.
Write a comparison about the differences in branching of these trees.

Observe and compare the foliage of trees.

How many different textures of foliage do you observe?
Do the leaves grow up from the branches? Or do they grow down?
Do the leaves grow all along the branch, or only at the ends?
Do the leaves hide part of the branch?
Find two trees with different textures and sketch your impression of the textures.

Observe and compare the colors in trees.

How many different colors can you find in the trees?

Observe one tree at various times of a sunny day and compare the light patterns.

Observe, sketch, or photograph the designs and patterns made by the shadows of trees.

Observe and compare the bark of trees.

How many different textures can you find?
Make bark rubbings with newsprint and crayon.

How do trees enhance the environment of your schoolyard?

WEED PATCHES

1. Look for the different colors of the plants. Arrange the colors in a list -- lightest to darkest:

______________ ______________ ______________

______________ ______________ ______________

2. Count and record the different kinds of plants that are below your knees: ____
   a. How many plants have few leaves? ____
   b. How many plants have many leaves? ____
   c. How many kinds of plants are stickery? ____
   d. Do any of the plants have flowers? ____
      List the colors of the flowers:

      ____

   e. Do any of the plants have seed pods? ____
      Describe the different pods: ______________________________

      ____

3. Now record the same data for the plants that are above your knees:
   a. Number of different kinds: _____
   b. Plants with many leaves? _____
   c. Plants with few leaves? _____
   d. Plants that are stickery? _____
   e. Do any of these plants have flowers? _____
      List the colors of the flowers:
      ____
   f. Do any of these plants have seed pods? _____
      Describe the seed pods: ____
      ____

4. Are there any plants higher than your head? _____
   Are there many, or just a few? _____
   Describe these plants: ____
   ____

5. On a separate piece of paper, choose one of the following to do:
   a. Choose one weed and write a riddle about it, using four of the five senses to describe it.
      Which of our five senses would you not use? __________
   b. Write a poem describing the weed, or a poem telling about the color "green."
   c. Write an imaginary story explaining how the tallest weed became so tall.

INTERPRETING CULTURAL HISTORY AROUND SCHOOL

Inventory building structures within a given distance from your school.

Develop a classification system for types of buildings. (Shape, roof shape, and type, materials in construction, etc.)

Develop a means of classification for age of buildings.

Map the vacant buildings within a given distance of your school.

Determine how long buildings have been vacant. (Observe deterioration, interview local residents, consult written records, etc.)
What function did the building perform when it was in use?
What factors caused the building to become vacant?
Who owns the building now? Is there another possible use for the building?

Make an inventory of fences within a given distance of your school.

What different types did you find?
What different materials have been used in the fences?

Develop a classification system for the fences you observed.

Develop a chart showing the type of fences and their most common uses.

If possible, find pieces of discarded fences and construct a board of these, listing uses for each.

Use aerial photo to locate section corners in your area. If possible, go to that location and look for a witness tree. See if scribing is identifiable.

Locate the watershed in which your school is located. What land uses are in that watershed?

Locate the source of your community's water supply. What changes have occurred in the water supply situation in your community?

BUILDING A LIVE PROGRAM*

How can outdoor activities be integrated into the school curriculum?

Environmental education has no identity as a separate body of subject matter or discipline. It is not an added subject in itself. It should not be considered a separate department, nor should one department be totally responsible for the program. It is applicable to all subjects, disciplines, and departments.

Basic concepts in each of the academic disciplines or subjects should be examined, for none are completely exempt from enrichment through outdoor activity. Some disciplines by their very nature seem to have more of an affinity to the outdoor environment than others. The problem is to relate subject matter at all levels to those activities that will logically and naturally allow those things that can be taught best outdoors to be taught there, and permit those items which can be learned best indoors to be offered there.

This section is presented in eight parts as follows:

Language Arts and Environmental Education
The Social Sciences and Environmental Education
Science and Environmental Education
Mathematics and Environmental Education
Music and Environmental Education
Arts and Crafts and Environmental Education
Health, Physical Education, Recreation and Environmental Education
A Model for an Environmental Education Program

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LANGUAGE ARTS AND ENVIRONMENTAL EDUCATION

The purpose of a language arts program in a school curriculum is to help students to become proficient in communicating thoughts, ideas, opinions, reservations, aspirations, and other aspects of human feeling. The communication skills usually stressed by the school program are speaking, listening, reading and writing.

The outdoor environment provides an excellent resource for stimulation of language arts activities. The outdoor laboratory stimulates a creative response which can be either real or imaginative.

A great amount of understanding about one's environment can be achieved through the communication skills. To communicate how one perceives the environment one must use all his senses to observe his environment. This will help the individual to learn, question, understand, appreciate, and enjoy the out-of-doors. New words are learned and used when communicating about the out-of-doors.

Some of the most productive language arts activities evolving from outdoor experiences are creative writing and oral expression. Vocabulary building will be automatic with each new experience. Effective verbal expression must grow out of an experience.

Descriptive writing may be a starting point for many pupils. Subjects such as "Now that you have visited the watershed project, what are your feelings about the conservation of water?" Or, "What did you like most about your outdoor school experience?" are possible as catalysts for descriptive writing.

The sharing of experiences and the dramatization of experiences are possibilities for the translation and reinforcing of basic conceptual schemes.

Suggested Language Arts Activities

1. Note-taking (field notes)
2. Letter writing
3. Creative writing, such as poems or stories
4. Storytelling
5. Reading stories and poems
6. Writing diaries or logs, newspapers, songs, and menus
7. Use of outdoor school library for reference reading
8. Labeling and identifying field specimens
9. Dramatizations
10. Role playing
11. Making charts, posters, and bulletin board displays

THE SOCIAL SCIENCES AND ENVIRONMENTAL EDUCATION

Social science teaches about the interactions of man with his environment and has as an ultimate objective the preparation of a well-informed and socially-active citizenry.

Social studies is a natural for the outdoor setting because of the personal and realistic learning opportunities the outdoor environment can provide. Environmental education can provide stimulating learning situations and opportunities for students to explore the influence of man on his landscape.

The "why" of conservation of natural resources constitutes the utilization of the social science approach. Students need to have direct experiences with environmental problems if they are to become aware of how they can participate in action programs leading to the elimination or modification of the environmental ills confronting contemporary society.

The "how" of conservation is related to the study of natural and physical sciences and knowledge in these areas is necessary if the conservation movement is to be accelerated to an effective level. The technique of problem-solving and an application of critical thinking is vital in the extension of the social science curriculum to the outdoor laboratory.

Summary

Through the natural sciences, what needs to be done to improve or maintain the environment is determined. The social sciences must be concerned with ways of effecting such changes through societal action.

Suggested Social Studies Activities

1. Visits to local historical sites
2. A field trip to a deserted farm
3. Exploring an old cemetery
4. A field trip to historical villages or museums
5. Exploring an old Indian occupational site
6. Exploring an old railroad bed
7. Surveying senior citizens of the community and tape-recording the interview sessions
8. Analysis of a region for human occupancy
9. Attending meetings of community planning and zoning boards
10. Exploring old sites of the early industries of a region
11. Visiting a state or national park
12. Making maps of a community's natural and cultural resources
13. Writing an historical chronology of a community, area, or region
14. Writing letters and articles related to the need for conserving man's natural resources
15. Visiting sites that are polluted

SCIENCE AND ENVIRONMENTAL EDUCATION

The curricular relationship between science and the outdoor laboratory is clear and concise. Science educators have been using the out-of-doors as teaching stations for many years.

A Helpful Discipline

Science can contribute a great deal to an understanding of the inherent values of our natural resources. Such understanding involves all subject matter areas; however, science can emphasize the "how to" of conservation activities. This will assist in the education of a voting population with sufficient background for coping with the problems of continued existence on earth.

Using Ideas

Perhaps the field of biology, with a particular stress on ecology, is the most natural academic subject matter area for environmental education. Many science programs use "man and his environment" as a central theme. Main ideas or generalizations are identified as significant to understanding this relationship. Concepts, or ideas pertinent to each generalization, are usually stated with suggested questions and activities designed to promote assimilation of these concepts. An example of this approach would be as follows: generalization .... all life is inter-related and dependent upon one another; concept .... organic life depends upon the environment for conditions of life; activity .... an ecological quadrat study of a natural area.

Guiding Principles

A guiding principle for science in the out-of-doors is that method is more important than fact. A second guiding principle is that generalization should be emphasized above factual knowledge. Facts are important in that they provide a basis for generalizations; however, unless they are used to formulate general principles, they have little value.

An Open-ended Approach

An excellent approach in teaching science is to develop basic understanding and reinforce their values through an "open-ended" or "discovery" technique. No answers should ever be given. The teacher, in many instances, may be learning side-by-side with the student. Often, this has been referred to as the "third dimensional teacher." The teacher should be willing to admit that he does not know all the answers, but has sufficient background to know where to look for the answers. Teachers exploring this method will display, along with their students, a fresh outlook and enthusiasm for learning.

The Scientific Method

For older students a research or investigative design comprised of the following steps may be employed:

1. Identification of the problem
2. Gathering preliminary data
3. Hypothesizing the solution
4. Stating assumptions
5. Gathering pertinent data to test the hypothesis
6. Acceptance, rejection, or modification of the hypothesis
7. Conclusions and recommendations

Learning theorists have generally agreed that this method is very effective for certain types of learning.

Suggested Science Activities

1. Ecological study of a quadrat
2. Transect study
3. Weather prediction
4. Pond ecology
5. Soil profile
6. Tree identification by physical characteristics
7. Trapping wildlife for study purposes
8. Development of a nature trail
9. Field succession study
10. Study of animal homes or habitats
11. Insect collection
12. Building a terrarium or aquarium
13. Testing for soil compactness
14. Exploring microclimates
15. Exploring fence rows

16. Star study
17. Animal population density studies
18. Analysis of plant incidence
19. Study of air and water pollution
20. Soil testing
21. Field notes on flora and fauna of an area or region
22. Observations of birds and bird nests
23. Study of a rotten log
24. Stump scouting or analysis of tree rings
25. Study of plant succession from water to dry land
26. Study of plant succession from meadow to forest

MATHEMATICS AND ENVIRONMENTAL EDUCATION

Historically, mathematics was developed by man to solve problems which confronted him. Man used parts of his body as standard units of measurement, and these very same units played an important role in the agricultural history of our nation.

Some Examples of Pattern and Form

In addition to this utilitarian aspect of outdoor measurement are the mathematical patterns and forms which seem inherent in nature. Examples of this pattern and form are to be found in the symmetry of leaves, leaflets, flower petals, flower parts -- such as stamens and pistils -- conifers, crystals of minerals, crystals of snowflakes, protective colorations of mammals, reptiles, and insects.

All of these examples of mathematical design in nature existed long before man ever attempted the development of sophisticated systems and equipment.

A Value Explored

Mathematics in the out-of-doors affords the student an opportunity to put basic concepts to work in the solution of real life problems. Ratios, areas, volumes, and linear measurement offer greater advantages for retention of learned materials because of their direct application to problems. Students can estimate sizes of objects, and distances, count, measure, compare mathematically, and draw maps including both land and aquatic area.

Remember

An outdoor or real life data gathering activity can be located or devised to illustrate and reinforce most mathematical procedures.

Suggested Mathematics Activities

1. Map-making
2. Measuring an acre
3. Contour mapping of lake bottom
4. Estimating volume of water flowing in stream

5. Estimating heights of trees, buildings, telephone poles, etc.
6. Compass orientation hike
7. Using leaves to show meaning of numbers
8. Comparing temperature readings
9. Using personal standards of mathematical units
10. Estimating distances by use of personal pace
11. Timing the travel rate of mammals, reptiles, and insects
12. Using various instruments for estimating heights, such as clinometer, isoceles triangle
13. Using spiral arrangement of leaves on plant to teach fractions.
14. Estimating the slope of a hill
15. Timber cruising for estimation of merchantable timber
16. Calculation of height and diameter of trees
17. Using triangulation in estimating distances
18. Using sighting level to determine land rise or fall
19. Identifying geometric shapes suggested by the landscape.

MUSIC AND ENVIRONMENTAL EDUCATION

One contribution the out-of-doors offers to the music curriculum lies in a study of the history and development of man's musical background. Man received inspiration from the sounds and rhythms of nature. Primitive instruments were undoubtedly developed from man's early interactions with his immediate environment.

A Proper Setting

Another contribution of the out-of-doors laboratory lies in the opportunity to provide an adequate atmosphere for musical participation by all, regardless of their native abilities and talents. An example of this is group singing around a fireplace or campfire. Individuals usually will participate in singing; but, they might not do so in a more formalized situation.

The emotional atmosphere of the informal group gathered together in a total group living situation can cause changes in behavior patterns.

Even those students who are reluctant to participate at school will take part in such activities as group singing or primitive instrument band concerts.

For Personal Growth

Music in the out-of-doors can be utilized by pupils in the development of an appreciation and concern for natural resources and their conservation by helping to uncover concerns and emotions about a number of environments. Original musical compositions of students are often very effective in revealing such feelings.

Suggested Music Activities

1. Listening to bird calls and recording their rhythm patterns
2. Identifying the sounds of footsteps on various surfaces, such as rock, gravel, grass, bare soil, sand, wooden bridges, etc.
3. Comparing footsteps on various surfaces to the sounds of string instruments
4. Comparing sounds made by striking objects of graduated sizes
5. Performing Indian dances
6. Experimenting with sound producing materials, such as rocks, trees, water, pebbles, pod seeds
7. Making primitive instruments
8. Group singing
9. Writing songs about things found in nature
10. Performing the gaits or flight patterns of mammals or birds
11. Identifying sounds in a variety of environments which have been coined directly into words
12. Tape-recording sounds of nature and putting them into a musical score or arrangement
13. Dramatizing the movement of reptiles, fish, and amphibians
14. Listening to night sounds and recording them

ARTS AND CRAFTS AND ENVIRONMENTAL EDUCATION

All environments are saturated with design and color. There are far more colors in the native environment than can be found in the average paint box.

Art is Awareness

Since the days of the caveman, who painted on the walls of his cave habitat, art educators have been utilizing the outdoor environment. Art is a way to enrich individual awareness and understanding of the world of nature and the world of man through an increased development of the senses, i.e. learning to observe, feel, smell, and taste. Awareness develops when individuals have opportunities to investigate and explore the detailed nature of objects.

Art is Observation

Through art out-of-doors the student will gain greater power of observation as he studies the object he sees, as well as the relationship of the object to the total environment. Enlarging or magnifying parts through the use of hand lens reveals new meanings about common objects we have viewed many times before and missed.

Art is Sensation

Firsthand experiences have direct appeal to the senses and the emotions. Art grows readily from experiences such as these. Tactile sensations lead to images not perceived by the eye. The individual awareness of differences and similarities is increased through perceiving how things feel.

Art is for Everyone

Using many environments will provide greater opportunities for art expression. Because of vast diversity, outdoor settings can provide these opportunities for expression for the talented student as well as those with lesser ability. Native materials are abundant and can be utilized at the discretion of the student; it is his prerogative to do so. The greatest contribution of outdoor environments lies in the inspirational and emotional atmosphere conducive to high quality performance and satisfying experience in the arts. Another major contribution is the availability of materials for creative art projects.

A Greater Need

Some aspects of art should be included in every environmental program. If man is being stripped of many of his powers to perceive, how then can man perceive the impact of the despoliation of his environment, and how can he create a more habitable environment for the future?

The out-of-doors abounds with a variety of opportunities to utilize photography, sketching, modeling, and painting. Nature offers many native materials which may help stimulate the student to express himself creatively.

The outdoor related program should be an extension of the school art program whenever possible. Art activities related to the outdoor environment should be utilized in situations where they contribute both to the outdoor related concepts and to art education.

Art in the out-of-doors may be categorized as those activites which interpret the outdoor environment, activities which produce natural phenomena, and those activities which display evidence or data gathered during the environmental education experience.

Firsthand experience in the outdoors provides many opportunities for creative expression, and an awareness of beauty in nature can be developed through the art media. Science, social studies, language arts, and other disciplines attain new meanings through art.

Suggested Art Activities

1. Constructing collages with native materials
2. Wool dyeing with native materials
3. Pebble-painting on sandpaper
4. Making a color chart using native materials
5. Weaving with natural materials
6. Sketching
7. Modeling with native clay
8. Building an outdoor kiln
9. Discovering shape and form in the immediate environment
10. Observing colors in nature during the different seasons
11. Sketching clouds on glass with a grease pencil
12. Sketching sounds of bird calls
13. Sketching plants and flowers
14. Making charcoal sketches

15. Making spore prints
16. Pencil rubbings of tombstones
17. Crayon rubbings of leaves
18. Pencil rubbings of various textures found outdoors
19. Making spatter prints
20. Making designs with leaves and ink
21. Making sand pictures
22. Shadow pattern designs
23. Spider web designs
24. Producing placemats
25. Weaving with native material, such as bark fibers
26. Making animals from twigs
27. Twig painting
28. Making plaster of paris casts
29. Tracing designs in snow
30. Pebble or seed collages

HEALTH, PHYSICAL EDUCATION, RECREATION and ENVIRONMENTAL EDUCATION

Within the field of physical education and recreation are many activities and experiences which can be further extended by an environmental education program. When the subject of health is included in an outdoor school experience, the possibilities for outdoor activity are unlimited.

Physical Education

Since most of the learning activities conducted out-of-doors entail a great amount of physical activity, the need for structured physical activities is reduced.

An Important Reminder

Do not repeat a physical or recreative activity that can be more effectively conducted back at the school site. This will insure an enrichment program rather than one of duplication.

Involving Other Subjects

There are excellent opportunities for correlation of physical education and recreation with other subject matter fields. An example of this would be the actual development of skills necessary to play Indian games and to do Indian dances -- an outgrowth of a social studies assignment. The home economics class can make the costumes and the industrial arts class can make the games. Native materials for physical activities, such as games, should be utilized because a great deal of knowledge may be accumulated far beyond just the physical skills required to play them.

Recreation

Recreation is defined as any activity chosen voluntarily, which gives immediate satisfaction or reward and is socially acceptable. This definition implies that for a recreational activity to be truly a recreative one, it must have the element of free choice and, consequently, should be directed during the free time provided by the program.

Health

Daily living in an outdoor setting requires adequate health procedures. In many instances the outdoor setting will relate the importance of health knowledge to specific activities, such as proper dress for a snowshoe hike, preparation for an overnight exploration trip, adequate footwear for a bog exploration.

Preparation in menu-planning will provide direct experiences in the application of sound health practices.

Activities involving animals may utilize methods of teaching cleanliness, correct food habits, parental care, dependability, life styles, history, and conservation.

The Role of Physical Education

The role of physical education in the environmental education program is no different than it is for other subject matter areas. Basic aims and objectives, including concepts and activities, must be first examined on the basis of how they can be applied most effectively. Once this is accomplished, physical education activities can then be projected into the environmental education program, and whenever possible correlated with the aims, objectives, and activities of other subject areas.

Another aspect of physical education in an environmental education program is its contribution to education for leisure. Leisure time activities natural to an environmental education setting may be the kind that will contribute to the balance that man needs in his life.

Physical education can make better use of the tremendous potential for teaching and learning outside the classroom. First, it must be willing to accept a philosophy of teaching that embodies the principle of individual differences and recognize the impact of the total environment on children and youth.

Suggested Health, Physical Education, and Recreation Activities

1. Playing Indian and pioneer games
2. Constructing a rope suspension bridge
3. Performing Indian dances
4. Stalking wild animals
5. Dancing pioneer or folk dances, such as round and square dancing
6. Participating in community service projects, such as cleaning a park, or construction of check dams for erosion control
7. Participating in outdoor recreation activities, such as swimming, boating, skiing, snowshoeing, ice fishing, canoe trips

8. Practicing outdoor safety, such as how to dress for a hike, what first aid equipment is necessary.
9. Participating in proper health measures, such as cleaning resident buildings, making beds, washing dishes, setting tables
10. Planning an outdoor menu
11. Building observation blinds
12. Playing nature games, such as tree tag, leaf passing, twig diaries, pitch pine tag, tree cribbage
13. Participating in stunts related to the out-of-doors
14. Developing hobbies related to natural history

A MODEL FOR AN ENVIRONMENTAL EDUCATION PROGRAM

Environmental education has been recommended for each grade, K-12, with foci on each or any of the commonly recognized areas of instruction. The Conservation and Environmental Science Center for Southern New Jersey has developed a number of curricular guides to meet this need. These units of study, called environmental education instruction plans, are designed with behaviorally-stated objectives, carefully graded lesson series on the indoor-outdoor-indoor module, suggestions for evaluation, and bibliographies.

Primary Grades

Area	Environmental Education Units
Language Arts	Sense Impressions
Science	Everybody Talks About the Weather
Science	What's Alive?
Social Studies	The Blueberry Bush
Art	Nature's Colors

Middle Grades

Language Arts	Tuning Up the Five Senses (exercises in observational skills)
Science	Compass and Map Skills
Science	Simple Machines in the Outdoors
Social Studies	Founding a Colony
Art	Coordinating with Environmental Experiences

Secondary

Science	Field Problems in Biology
Science	Biological Effects of Fluctuating Water Levels
Social Studies	Historic Site Study
Mathematics	Angling for an Unknown Dimension

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ENVIRONMENTAL INVOLVEMENT...a teacher's guide

Introduction

To teachers: These lesson ideas and projects are only a starting point for your students and you to become involved in your environment. These give you an opportunity to learn, as well as teach, through commonplace activities which you may or may not ordinarily do either in your classroom or away from the classroom. These projects give you a perspective as to:

1. What to look for

2. What to be aware of

They are intended to help you appreciate the effect of your actions on your environment and you. They are also intended to encourage a responsible attitude toward your environment.

The various Levels (i.e. Level I, II, III, IV) roughly correspond to grades K-3, 4-6, 7-9, 10-12.

To students: This is a new opportunity for you to do new things, to see how you learn by doing them, and to develop your attitude about the effects of what you and others around you are doing to your environment.

Sharpening the Senses

It's very easy to get started. You need no preparation, no books or equipment. You need to find a clear space outside and divide into groups of three or four students. Have each group spread apart from the others and ask them to:

1. Look around and remember the things they see. (While they are looking, observe things you think they may not notice such as: the bird in the tree, the worm on the ground, the broken branch, the blade of grass, the bare spot of earth, the ant, the cloud, the piece of paper, the tin can).

   Reassemble and have them tell what they saw. You may want to list these to encourage them to participate. You may want to mention some of the things you observed to encourage further participation.

   What do they like about what they see? Why?

   What don't they like about what they see? Why?

What, if anything, can be improved by a specific change? How can this change be made? Who should make the change?

2. Separate into groups again to listen for everything they can hear. Follow the same procedures as section 1.

3. Same as section 1 except they smell everything they can.

4. Same as section 1 except they feel everything they can.

The above steps may take place over four separate sessions or combined, depending on available time.

ENVIRONMENTAL INVOLVEMENT. . .a teacher's guide

Level I

WATER QUALITY

Main Purpose: The awareness and appreciation of...

1. Water Pollution (Using your senses to evaluate)

Materials: One quart of:

a. City water fresh from the tap
b. City water after setting for twenty-four hours
c. Well water
d. Stream or ditch water*
e. Rain water collected in a container setting out in the open
f. Rain water off a roof*
g. Dilute vinegar
h. Dilute NaOH (caustic) solution (one pellet per quart)

* Note: Do not taste stream or ditch water or rain water off a roof.

Procedure:

Before you start, show them how to taste the water by sipping from a paper cup and not swallowing it. Let them see, smell, feel and taste each sample, describe it. Make up a chart for them to fill in. See example on next page:

Sample No.:	a.		b.		c.		d.		e.		f.		g.	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Does it look good?														
Does it feel good?														
Does it smell good?														
Does it taste good?														

Conclusions: Which sample looks, smells, feels and tastes best? Which is best for drinking? Which is worst? Then explain what each sample was and how it can be improved by treatment. The vinegar (acid) feels "squeaky." Bases are slippery. If it isn't either, it is generally neutral.

2. Water Pollution (Using your senses to evaluate)

Materials: One quart of soapy water (dish water) and one quart of tap water.

Procedure:

Note the appearance and odor of both samples at the start. Put in a quiet area out of the sun. Let the students guess what will happen to each sample in an hour and by the next morning. Then note the appearance and odor of each sample at the suggested time intervals.

Conclusions: Did they guess right? Has anything settled out? What does this mean to the whole community? Do they think dish water is good for people to drink?

3. Water Pollution Treatment (Using your senses to evaluate)

Materials: The above samples of soapy dish water and tap water, filter paper or paper towels, funnel, aerator from a fish aquarium, and an empty container for each sample.

Procedure:

Pour water into separate containers through the filter shaped into the funnel. Put the aerator tube into this filtered water for one hour; 24 hours. Note any change in appearance, odor or taste. Let the children make predictions before and after each step.

Conclusions: What are their conclusions about the effects of settling, filtration, and aeration on the appearance, odor, and taste of the water?

4. Soil Management and Its Contribution to Water Pollution (Using your senses to evaluate)

Materials: Two pie tins, tin can with perforated bottom, enough soil to fill two pie tins evenly, grass seed, and two containers to catch runoff water.

Procedure:

1. Sprinkle grass seed on one pie tin with the soil in it, press the seed into the soil, and moisten well. Place in sunlight and water twice daily. Let it grow for approximately two-three weeks.

   Note: Step 1 is a separate project, which can be used with the following experiment. As an alternate to Step 1, a piece of sod about the size of the pie tin can be used instead.

2. Set pie tins (one with soil and grass and the other with soil alone) on a slant on the edge of a table with the catch basins on the floor under them. Sprinkle equal amounts of water on the two pie tins. Compare the amount of soil in each catch basin.

Conclusions: Put the water into an aquarium with fish. What happens? Will hamsters drink the water? Would the children drink the water? Have someone take dictation from those who cannot write their story. What can people do to prevent this runoff?

3. Conduct a field trip to locate some barren spots and to plant grass seed or other vegetation. Go back periodically to check the effectiveness of the seeding in controlling erosion. The project, when completed, may be newsworthy for the school or local newspaper.

SOUND QUALITIES AND NOISE

1. Kinds of sounds

1. Take the class to several different "listening" places. Have them describe the sounds they heard. Make a comparison of sounds which are pleasant and which are unpleasant (noise). What causes the sounds?

   Can anything be done to correct the noise (polluted sounds)? Why are the sounds pleasant and unpleasant? What can be done at home to take care of the noise? Where do they think it is best to run and shout? To play table games, etc.?

2. Work with the children and make a list of sounds, ranking them as to which are pleasant and unpleasant. What makes these noises? What can be done to make them pleasant?

3. Assign children (with help of a parent) to make a list of sounds heard at home and bring the list to school. What made these sounds? Which are pleasant and unpleasant?

4. Have the children draw or cut out pictures that suggest pleasant and unpleasant sounds to them. Evaluate their learning of the idea by ranking them in order from pleasantness to unpleasantness. (Or just which are and which are not noise).

AIR QUALITY

1. Evaluating Air Pollution by Odor

Materials: Equal sized, covered, glass containers for each of the items. The following suggestions are possible examples:
Onion, peanut butter, moth ball, perfume, aerosol hair spray, auto exhaust, vinegar.

CAUTION: In using the senses as a detector, you should always be extremely careful since the material may be toxic.

Procedure:

1. Rub a piece of the onion on the sides and lid of container and close.
2. Rub the peanut butter on the sides and lid of container and close.
3. Rub one drop of vinegar on the sides and lid of container.
4. Place moth ball in container for five minutes, remove, and close the lid.
5. Rub a drop of the perfume on the sides and lid of container and close.
6. Make one short squirt of aerosol hair spray into the container and close.
7. Capture auto exhaust by placing open container at exhaust pipe of running car and quickly closing lid.
8. One container with nothing in it as a control for comparison.
9. Number each container.
10. Guess what causes the odor in each numbered container. After everyone has smelled each container, discuss what they think it is. Is it pleasant or unpleasant? What can you do at home to get rid of an unpleasant smell? What is one way to tell if the air is polluted at home? Which smells are pleasant? Unpleasant? List them. Is this way adequate for all air pollutants?

SOLID WASTE CONTROL

1. Ask children to keep an eye open for litter on their way home and give a report to the class the next day. Teacher can check the location to see if it warrants showing the whole class. If so, walk the class there and pick up all litter on the way and at the spot. Put it in a garbage bag. Point out how nice the spot looks now.
2. In the classroom, examine collection and list kinds of litter. How did it get there? What can the children do to keep it clean? What can they suggest that others do?
3. Have each child look in his or her desk and around room. Are these areas free of litter?

4. Burn a cotton rag, a piece of string, a piece of paper and a peanut butter sandwich over an aluminum pie tin. Hold with a pair of pliers. Keep children at a safe distance. Is the smell pleasant? Have the children noticed anyone burning anything in their neighborhood? Does it look or smell good? (Tell mom and dad that it smells and looks bad, and it is usually against the law.)

5. Have each child look around home and see what they can do to get rid of litter. (Old cloths, rags, papers, messy garbage cans, own bedroom, toys untidy, etc.). In class, let each child tell what he did that day to make his "world" a cleaner place to live.

6. Draw pictures of areas before and after cleanup. Write a poem or story to go along with the picture. Have upper class students take dictation and make final copy for them if they cannot write. Publish in school newspaper or publish a class booklet. Share it with other schools so they can get involved. Maybe the class would like to volunteer to keep a certain section of playground clean.

7. Have children list or tell you about the kinds of solid waste litter. Who causes it? What can be done? (This is a means of final evaluation.)

ENVIRONMENTAL INVOLVEMENT...a teacher's guide

Level II

SOLID WASTES

(This following project is also appropriate for use at Levels III and IV.)

Materials: Have students bring from home or neighbors' household appliances that do not work for one reason or another. Can openers, electric irons, toasters, etc.

Procedure:

In groups of two to four disassemble an appliance or examine it carefully to try and determine what is not functioning properly and why. This disassembly should be done with the firm understanding that the appliances are to be reassembled even if it is impossible to repair.

Conclusions: Evaluate what would be needed to put the appliance in working order, even if the part is not available or service cannot be done in the laboratory (classroom). Can parts from one appliance (toaster) be used on another (toaster)? If not, why not? Discuss the benefits and disadvantages of the ability to interchange parts. Have students determine availability, information and prices by writing manufacturer, or distributor whether repair is intended or not.

WATER QUALITY

Main Purpose: Extending the awareness, developing measuring tools and experimentation...

1. Water Pollution: Examine and measure two or three water samples to define suspended and dissolved matter. A field trip to collect samples of water from local sources is suggested. Note evidences of pollution, such as floating matter, appearance and odor.

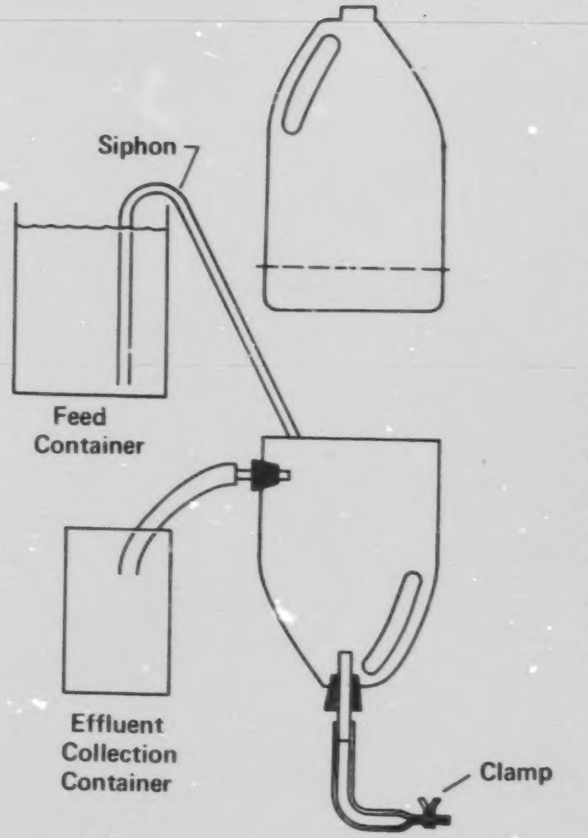
   Materials: Samples of water, about one gallon each of river water, drinking water, well water and rain water. Filter paper and funnels. Beaker or other vessel suitable for evaporation of the water. Balance for weighing residues on filter paper and in beakers.

   Procedure:

   1. Divide water samples into measured portions for each group of students for which a set of materials is available.
   2. Weigh the filter paper and beaker; filter water sample through the weighed paper; dry and re-weigh paper.
   3. Collect and evaporate filtered water in weighed beaker by whatever means are available; re-weigh the beaker.
   4. Note and evaluate the residue weights and how they relate to the purity of the water.

   Conclusions: What conclusions can be reached regarding which water would be best for drinking? What other uses of this water might be suitable?

2. Waste Pollution Treatment: Construct and operate a clarifier which is used to remove suspended solids by settling (sedimentation).



Materials: For each demonstration unit

Plastic bleach bottle (one gallon)
Two rubber stoppers (to fit openings)
Rubber tubing 4-6 ft.
Razor blade
Glass tubing - two short pieces
Waste storage container
Treated waste storage container
Water
Few handfuls of dirt (soil)
Assorted cork borers
Tubing clamps
Ring stand
Clamps or rings

Procedure:

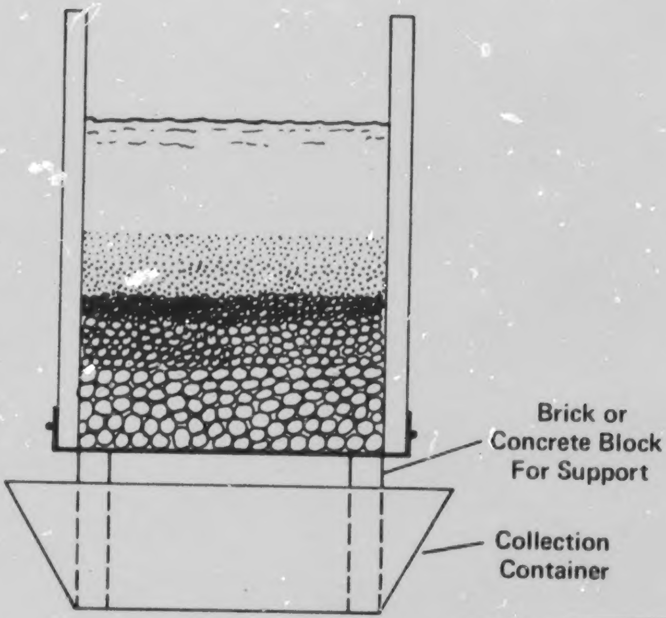
1. Cut and fit bottle as indicated in the drawing. Bore holes through bottle and rubber stoppers. Fit stoppers and glass tubing into bored holes and the bottle opening.

2. Connect rubber tubing to glass fittings. Fill waste storage container with water and add dirt. Mix thoroughly. Establish siphon feed to clarifier and effluent tube to the treated waste storage container.

3. Compare waste water in the clarifier with the overflow or treated effluent. Remove clamp from bottom tubing and collect the matter which hopefully flows out. It may plug with dirt off the bottom. Filter effluent.

Conclusions: Compare the influent quality with the effluent quality visually. Is there any improvement in clarity? Does this appear to be adequate treatment for drinking water? For any other use?

3. Waste Treatment: Explore the effects of "percolation", as a water treatment method, by constructing a classroom model. "Percolation" is a natural process by which water is filtered several times by various soils in its passage from the surface to the water table.



Materials:

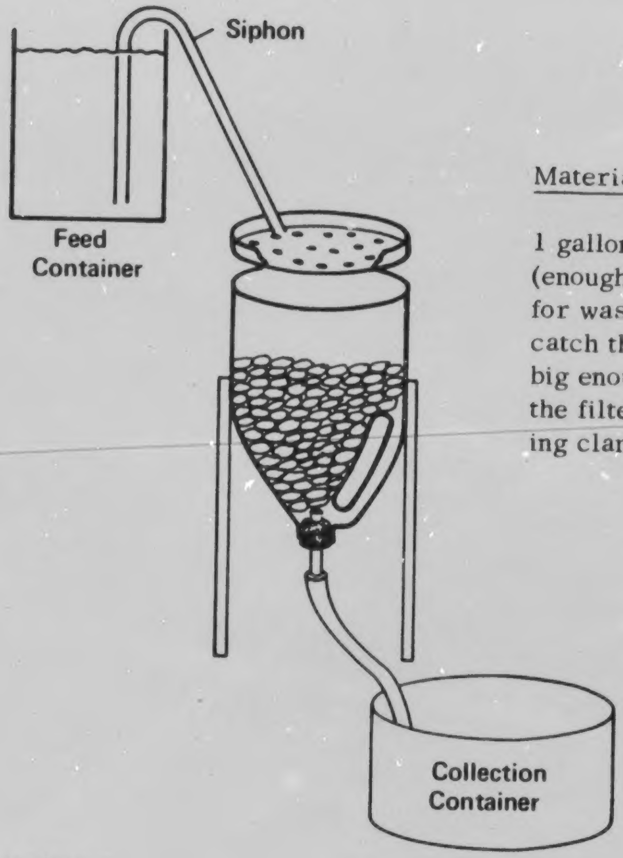
Metal, glass or plastic cylinder about 12" to 24" long and about 6" or greater diameter. Wire or plastic window screen, about 1' square (to cover one end of the cylinder). Two to three feet of bendable wire (stove pipe wire) to fasten screen to end of cylinder. Coarse gravel, pea gravel, coarse sand and fine sand sufficient for about two-four inches of depth for each in the cylinder. About one gallon of a dirty water (dishwater).

Procedure:

1. Fasten window screen securely over one end of the cylinder with the wire.
2. Add layers of gravel and sand from the more coarse to the finest.
3. Place a collection container under the cylinder and pour the dirty water into the top of the cylinder.
4. Collect water for examination as to clarity and appearance.

Conclusions: Is there any apparent improvement in water quality? Is this an adequate treatment method for drinking water? For other uses?

4. Waste Treatment: Explore the effects of biological trickling filter as a waste treatment method by constructing a working model. A "biological trickling filter" is a natural process by which bacteria take pollutants from the waste, and oxygen from the air, to oxidize these materials to carbon dioxide and water.



Materials:

1 gallon plastic bleach bottle, crushed rock (enough to nearly fill the bottle), containers for waste to feed the trickling filter and to catch the effluent. The containers should be big enough to hold about one day's flow over the filter. Rubber tubing 2-3 ft. long. Tubing clamp.

Procedure:

1. Cut bottom off the bottle about one inch from the bottom. With a nail punch holes in the bottom in such a manner as to distribute them evenly over the bottom surface but not closer than 1/2 inch to the outside edge.

2. Invert bottle, place in a holder, fill with the crushed rock almost to the top.

3. Place effluent container under the bottle opening.

4. Establish a siphon from the waste feed container to the inverted bottom of the bottle (on top of the inverted bottle). Continue flow of waste water by recycling until a growth of bacteria (slime) is noted on the rocks, and the apparent quality (clarity and odor) of the effluent is good.

Example:

Data Sheet

Effluent Qualities

Date	Clarity	Odor	Litmus (pH)	Observer

Conclusions: Did the bacteria grow from the food in the waste? Is there any apparent improvement in the water quality? Do you think this method would be adequate treatment for drinking water? For other uses?

SOUND QUALITY AND NOISE (POLLUTED SOUND)

1. Kinds of Sounds - Listen to tape recordings of various sounds which can be collected from every conceivable location. Have students try to identify these sounds and evaluate. Which sounds do the students consider noise? Why? What changes can be made in the noises to make the resulting sounds tolerable? Pleasant?

2. What range of sound qualities are pleasant? Tolerable? Intolerable? What makes them pleasant, tolerable,or intolerable?

AIR QUALITY

1. Air Pollution: Collect and examine airborne particles.

   Materials: A piece of cardboard approximately 12" square covered on one side with masking tape - sticky side up. A clear plastic film can be used to protect the sticky tape until you are ready to collect particles.

   Procedure:

   1. Place a tapeboard on an outside school window sill, facing the general direction of the wind and airborne particles.

   2. Place a tapeboard on an inside school window sill.

   3. Make tapeboards for the children to put inside their homes and bring back to school in a week.

   4. Burn a newspaper or cardboard box outdoors when there is a slight breeze blowing. Place tapeboards about 4 to 6 feet upwind and downwind of the fire. Determine the difference in the amount of particulate matter collected on each. Observe smoke or its absence.

   5. In each case, ask what they think will happen. Watch tapeboard each day for results. Where do the particles come from? What can be done to eliminate these particles? Why is there a difference by location?

NOISE

Main Purpose: Further develop working tools for the measurement, evaluation, and control of noise (polluted sound) along with the appreciation of quality sound.

1. Suggestion: Review the Levels I and II activities and involvements. Use the ones that are applicable, and carry them into greater detail at your discretion.

2. Using a decibelmeter or an audiometer measure the volume of the various sound sources at school or on a field trip. Suggested locations: woods, gym, street corner, classroom, typing room, wood shop or study hall. Set up your raw data in a table from the lowest to the highest volume and compare with a decibel chart in the encyclopedia. In the students' opinion, which is or isn't polluted sound? Is the same sound always polluted or non-polluted? What makes the difference? How does polluted sound affect you under various conditions? What can be done to change or control polluted sound or the conditions under which polluted sound affects you?

3. Connect this with the study of the physical aspects of sound.

WATER

Main Purpose: Further develop the working tools of measurement, evaluation and appreciation of water quality and control of pollution.

1. Suggestion: Review the ideas presented for Levels I and II. Some of these ideas can be further developed for this level of understanding (Level III), especially with more sophisticated measuring tools and techniques.

2. Field trips, research, classroom discussion, community exploration. Where does all the sewage come from? Where does the waste water from the school go? With a city or area map, study where the sewers serving the school go.

   Trace the route to the treatment facility and to the water course receiving the treated waste water. Sample it. See if its appearance and odor would make it suitable for drinking, irrigation, swimming, boating or industrial use. Note the qualities the water has, or doesn't have, for each use. Discover the additional treatment needed to meet these uses.

   Where does the drinking water come from? How is it treated before use? What quality water is it? Is it hard water? Soft water? Is it high in dissolved matter? Evaporate a filtered sample to find out. Did the filter show any suspended matter?

SOLID WASTES

Where does the trash and garbage from the home and school go? Is it collected? Is it burned in the backyard? If it is collected, where does it go? How is it disposed of? Landfilled? How long will the present landfill last? How much area will be needed for the future (10 years)? Are the combustible wastes burned? How? Does this incineration cause air pollution? Is any of the rubbish salvaged? What? How much more could be salvaged? Reused?

AIR POLLUTION

Corrosion test panels made from aluminum foil strips can be placed outdoors at various locations around the school and community. Similar test panels can be placed inside closed jars at the same locations to show the difference between strips exposed and not exposed to the atmosphere. Particulate collectors at the same site can give additional data. Compare visually. Determine: Which areas are most corrosive? Which areas have the most particulate matter? Is the particulate matter corrosive? What could be the source of the corrosion? Can additional test panels pinpoint the location better? Is this amount of corrosion or particulate matter a problem? If it is a problem, what can be or is being done about correcting the problem?

SOIL

What are the types of soil? How can you determine the type of soil? What types of soil hold water? Plant nutrients (fertilizers)? Resist erosion? What soil is the most difficult to separate from water? Is any soil damaging to fish and aquatic life? If so, which?

ENVIRONMENTAL INVOLVEMENT...a teacher's guide

Level IV

NOISE

Main Purpose: The study of noise (polluted sound) as it is applicable to the specific science.

1. Suggestion: Review the ideas for Levels I, II and III and choose the ones which might be usable for the particular science. The suggestions below are only a beginning.

2. Biology:
   a. What are the effects of ultra and subsonic sounds on plants.
   b. The effects of loud (178 decibels) and soft (20 decibels) sounds on plants.
   c. The effect of a. and b. on animal behavior. Is it related in any way to how people react?

3. Physics: The measurement of polluted sound on an oscilliscope in comparison to unpolluted sound. Is there any difference in its "picture" that would give you

a hint as to why it is considered polluted sound? What can be done with acoustics to make this polluted "picture" pleasant? Are there other control methods being used? What are they? How do they work? Can you create your own methods of controlling a polluted sound?

4. Chemistry: a. What are the effects of ultrasonic and subsonic sounds on the crystal formation? Is it different for various kinds of crystals?

   b. Do the same thing for high decibel sounds and low decibel sounds.

AIR

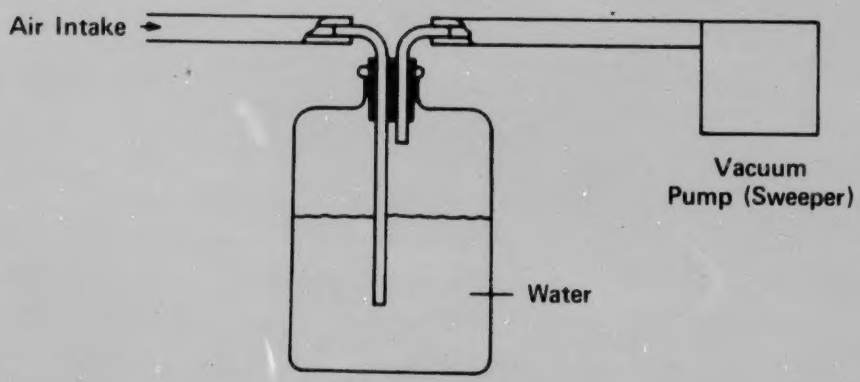
Main Purpose: More detailed working tools for measurement evaluation and the control of air pollutants.

1. Biology: Determine if there are any airborne micro-organisms. Collect with a microfilter or scrubber, and examine under a microscope.

2. Physics: Determine the amounts of particulants ($\mu g/m^3$) present in the air by microfiltration. Note the wind direction to determine the source of pollution. Can filtration be used as a means of controlling particulate air pollution?

3. Chemistry: Determine the pH, oxidants, and reductants present in scrubber water. Note wind direction to determine potential source.

SKETCH of SCRUBBER



WATER:

1. Biology: Sample the bottom of a stream. Determine the species and population present. Examine a sample of river water. What organisms are present?

2. Physics: What effects do impurities in water have on the evaporation of water? On freezing water? How do the impurities in water effect its surface tension? Capillary action?

3. Chemistry: Determine the dissolved oxygen content of a water sample.

Educational Materials Available

SOURCES FOR CURRICULUM AND ENVIRONMENTAL EDUCATION DIRECTORS

DIRECTORY OF NATURE CENTERS AND RELATED ENVIRONMENTAL EDUCATION FACILITIES

An updated version of the first directory and guide to the facilities and programs important to teaching conservation and environmental education. It is part of a continuing effort on the part of the National Audubon Society to stimulate interest in nature centers, improve communication among the various facilities and encourage the development of new and better facilities. $3

National Audubon Society
1130 Fifth Avenue
New York, NY 10028

ENVIRONMENT AND THE SCHOOLS

An important survey of the development of environmental education in the schools, presenting a good overview of philosophy and perspectives, an outline of the Environmental Education Act, and descriptions of pioneering programs at the national, state, and school district levels. Information regarding the development of outdoor laboratories on school grounds, and guidelines for environmental education programs are also included. Stock No. 411-12782. $4

National School Public
Relations Association
1201 16th Street, N.W.
Washington, DC 20036

ENVIRONMENTAL EDUCATION IN THE PUBLIC SCHOOLS

Results of a nationwide survey of programs in environmental, outdoor, and conservation education in operation in public schools in 1969-1970, to determine the current status of programs in environmental education and the use such programs make of local, state, and national park services and resources. The statistics reveal considerations important to the development of environmental education programs. Stock No. 435-25450. $1.50

NEA Publications
1201 16th Street, N.W.
Washington, DC 20036

ENVIRONMENTAL EDUCATION NEWS FOR SCHOOL PEOPLE

A free newsletter published by the Information and Education Division of the Michigan Department of Natural Resources and available to school librarians and environmental educators. Events and items of interest are outlined and new environmental education materials reviewed.

Environmental Education News
Michigan Dept. of Natural Resources
Lansing, MI 48926

OPEN EDUCATION, ALTERNATIVES WITHIN OUR TRADITION

The authors, Joseph D. Hassett and Arline Weisberg have built a practical approach to environmental education through the open classroom experience. A package of teaching/

learning skills was developed in urban New York City schools. This is exciting, new material for the environmental educator. 138 pp. $3.95, paperback, and $7.95, hard cover.

PROGRAMS IN ENVIRONMENTAL EDUCATION NSTA 1971

A description of more than 50 selected programs in Environmental Education around the country. Only programs now underway and able to distribute materials and/or information have been included. Stock No. 471-14393. $1.50

NSTA
1201 16th Street, N.W.
Washington, DC 20036

THE SCHOOLS AND THE ENVIRONMENT: A REPORT OF A NATIONAL SEMINAR

The report of an Institute for Development of Educational Activities, Inc. sponsored seminar presents a case for environmental education in the schools, examines the Environmental Education Act, and constructs guidelines for schools to follow in developing environmental studies. The Niskayuna School District K through 12 environmental and community health program is summarized, audio visual aids and books listed. $1.50

I.D.E.A.
P.O. Box 628
Far Hills Branch
Dayton, OH 45419

SOURCEBOOKS FOR TEACHERS

A COMPILATION OF MATERIALS FOR ENVIRONMENTAL EDUCATION

This 52-page mimeographed booklet was prepared by the Environmental Education Project of NEA. It describes (and locates) curriculum materials, books, periodicals, audio-visuals and bibliographies. Although not comprehensive, it is an excellent source of information, and no interested teacher should be without one. Single copies free.

Environmental Education Project
National Education Association
1201 16th Street, N. W.
Washington, D.C. 20036

ENVIRONMENTAL EDUCATION -- A SOURCEBOOK

The book is an excellent collection of materials in environmental education resulting in a most useful sourcebook edited by Cornelius J. Troost and Jarold Altman. Hardcover: $11.95; softcover: $8.95.

John Wiley & Sons, Inc.
605 Third Ave.
New York, NY 10016

ENVIRONMENTAL WORKBOOKS

A series of eight workbooks is available which outlines problems, discusses alternatives and solutions, cites scientific information, gives examples of citizen action and provides a bibliography. The individual titles are:

Air Pollution
Water Pollution
Hunger
Environmental Effects of Weapons Technology
Environmental Education
Nuclear Explosives in Peacetime
Environmental Cost of Electric Power
Pesticides

Each costs $1 ($.75 each for more than 10) or $5/set.

Scientist's Institute for Public Information
30 East 68th Street
New York, NY 10021

INTRODUCTION TO ENVIRONMENTAL SCIENCE

This book, written by Phillip W. Foster is a well done and up-to-date programmed learning aid in environmental science aimed at the basic college level. Sections progress from "Historical Perspective" to "Environmental Trade-offs and Public Policy." $3.50. 181 pp.

Learning Systems Co.
1818 Ridge Road
Homewood, IL 60430

VITAL VIEW OF THE ENVIRONMENT

Pamphlet indicates the major concepts in relation to the environment around which activities can be planned, education programs can be built or related concepts developed.

No. 471-14604 $1.40
N. S. T. A.
1201 16th Street, N. W.
Washington, D.C. 20036

Educational Materials Available

SOURCEBOOKS FOR STUDENTS

ECOLOGY PROGRAM (grades 4 to 6)

An interdisciplinary approach to environmental problems in three parts; each has 48 pages, and a teacher's guide is available. 35¢ each

Book A. Ecology: Nature and Needs (grade 4) Code 871
Book B. Ecology: Habits and Habitats (grade 5) Code 872
Book C. Ecology: Problems and Progress (grade 6) Code 873

American Education Publications
Education Center
Columbus, OH 43216

CIRCLE OF THE WORLD (grades 7 to 12)

Readings that discuss man's interaction with the environment, ecological cycles and problems.

Grades 7 to 9 Readings in Ecology I (No. 1720) $3.20 ($2.40 school)
Grades 10 to 12 Readings in Ecology II (No. 1722) $3.20 ($2.40 school)
(Teacher's editions listed under Curriculum Section)

Benziger, Bruce & Glencoe, Inc.
866 Third Avenue
New York, NY 10022

WEB OF LIFE (intermediate grades)

A set of 10 well-written and beautifully-illustrated books presenting basic ecological concepts (energy paths, food chains, populations, communities ecosystems, etc.). The volumes include an overview, six biomes and three man-made habitats. Can be used independently or as a sequential set. Written at the 4th grade level but applicable through junior high school.

1700. Ecology
1701. Ecology: The Forests and Man
1702. Ecology: The Deserts and Man
1703. Ecology: The Grasslands and Man
1704. Ecology: The Mountains and Man
1705. Ecology: The Freshwaters and Man
1706. Ecology: The Oceans and Man
1707. Ecology: The Farm
1708. Ecology: The Suburbs
1709. Ecology: The City

Each paperback book is 64 pages and contains an index and glossary. Cost $1.60 each (school price $1.20 each). See Curriculum section for teacher's guides.

Benziger, Bruce & Glencoe, Inc.
(see above)

THE CROWDED WORLD (primary grades)

An introduction to the study of population and its meaning for the world. It was prepared by the Population Reference Bureau and has photographs and graphs included. $1.50

Columbia Books
917 15th Street, N.W.
Washington, DC 20005

ECO AMERICA NEWS

The ECO America News is a free "picture newspaper" available to high school ecology clubs. Individual club activities, awards, and letters and suggestions from club members are reported. ECO America is sponsored jointly by Pepsi-Cola Company and Keep America Beautiful, Inc. To apply for club membership or obtain the newsletter, write to:

ECO America, Room 2200
99 Park Avenue
New York, NY 10016

MIKE'S WORLD YOUR WORLD (grades 5 to 8)

A look at our environment directed to four concepts: Scarcity, Interdependence, Personal Responsibility, and Value Conflicts. Aimed to help every youngster become aware of what he can do toward bettering the environment. Paper, 32 pp. The student book and teaching guide are 75¢ each.

Education Ventures, Inc.
209 Court Street
Middletown, CT 06457

MAN AND THE ENVIRONMENT (jr. high)

An introductory life science program with an ecological emphasis separated into four problem-centered units: Investigating Living Things, The Environment Affects Living Things, Living Things Affect Each Other, and Man Affects the Environment. No. 2-15190. $5.22

Houghton Mifflin
Geneva, IL 60134

RYERSON SCIENCE IN ACTION SERIES

Canadian outdoor educators developed this excellent series for use by students and teachers. It is an activity centered series supported with superb illustrations and questions. Could easily be used for independent studies by students in the middle grades. $3.25

Titles include: Studies for Open Places
Studies for Woodlands
Studying Birds
Studying Insects
Studying Mammals
Studying Plants
Studying Soil
Studying Streams

Ryerson Press
Toronto, Canada

WE NEED EACH OTHER (grades 1 to 2)

An activity book which relates the concepts of ecology for young elementary children. Large type, short sentences, photographs and diagrams. No. 4304 (minimum order 24) 75¢ each

Scholastic Book Services, Inc.
904 Sylvan Avenue
Englewood Cliffs, NJ 07632

BETTER ENVIRONMENT BOOKLET SERIES

A series of 8 educational cartoon booklets about environmental topics. Single copies are 25¢ each and quantity discounts available (e.g., 10 to 99 @ 12¢). See also teacher's guides in Curriculum Section.

The Story of Land
The Wonder of Water
Help Keep Our Land Beautiful
Making a Home for Wildlife on the Land
Food and the Land
Working Together for a Livable Land
Plants, How They Improve Our Environment
The Earth, Our Home In Space

Soil Conservation Society of America
7515 N.E. Ankeny Road
Ankeny, IA 50021

CONSERVATION SCIENCE FAIR PROJECTS

Information on selecting and organizing a science fair project; includes suggestions and references for 60 projects. $1

Soil Conservation Society of America
(see above)

BEFORE NATURE DIES, Dorst, Jean

A comprehensive, photographically illustrated treatment of man's impact on nature written by an eminent zoologist. Jean Dorst treats the earth as a unit and provides a broad perspective on the effects of industrialization. His concluding chapter, Man in Nature, is especially compelling as a plea for rational land use. 352 pp. $2.45 softcover.

Penguin Books

ECOLOGY: MAN'S RELATIONSHIP TO HIS ENVIRONMENT, Pauline and Weishaus

A very good general treatment of environmental problems, what has been done about them, what may be done in the immediate future, and what should be done in long-term efforts to control problems which disrupt ecological relationships. The book would be a valuable enrichment of social studies programs at the junior-senior high level, 211 pp. $2

Oxford Book Co.

CURRICULUM AND COURSE MATERIALS

AIR POLLUTION EXPERIMENTS (Grades 7-12)

A manual of experiments for the science classroom to acquaint students with some of the problems and effects of air pollution and practical means of overcoming them. $1.00

Air Pollution Control Association
4400 Fifth Avenue
Pittsburgh, PA 15213

AIR POLLUTION PRIMER
AIR POLLUTION EXPERIMENTS FOR JUNIOR AND SENIOR HIGH SCHOOL STUDENTS

Frank H. Bozarth
Assistant Executive Director
Indiana Tuberculosis & Respiratory Disease Association
30 East Georgia Street, Room 401
Indianapolis, IN 46204

BETTER ENVIRONMENT BOOKLET TEACHER'S GUIDES

A guide is available for each of the SCSA Better Environment cartoon booklets and designed to assist teachers in using these educational series. Each guide has a central theme, objectives, key words, discussion questions, suggested activities and core concepts. Single copies are 25¢ each (quantity discount 2 to 9 copies, 15¢ each e.g.) and the set of eight is $1.00. (See also under sourcebooks for students).

No. 1. - The Story of Land
2. - The Wonder of Water
3. - Help Keep Our Land Beautiful
4. - Making a Home for Wildlife on the Land
5. - Food and the Land
6. - Working Together for a Livable Land
7. - Plants, How They Improve Our Environment
8. - The Earth, Our Home In Space

Soil Conservation Society of America
7515 N. E. Ankeny Road
Ankeny, IA 50021

CIRCLE OF THE WORLD: READINGS IN ECOLOGY (Grades 7-12)

Teachers editions for books listed under sourcebooks for students.
Vol. I (Gr. 7-9) No. 1721. $3.20 (school price, $2.40)
Vol. II (Gr. 10-12) No. 1723. $3.20 (school price, $2.40)

Benziger, Inc.; Web of Life Information
866 Third Avenue
New York, NY 10022

A CURRICULUM ACTIVITIES GUIDE TO WATER POLLUTION AND ENVIRONMENTAL STUDIES

Loose-leaf, 3-ring, drilled copy.

Institute for Environmental Education
8911 Euclid Ave.
Cleveland, OH 44106

EDUCATION FOR SURVIVAL: ECOLOGY IN SCIENCE AND SOCIAL STUDIES

Based upon the assumptions that environmental education should be an integral part of the social studies and science programs and not taught separately and that concepts should be explicitly developed and accompanied by classroom experiments, field trips and supplemental activities, it includes a comprehensive curriculum outline to show framework with which environmental education is taught. Developed by teachers of the Madison Public Schools.

Grades 1, 2, 3 (241 pages)	$5
Grade 4 (87 pages)	$3
Grade 5 (260 pages)	$5
Grade 6 (129 pages)	$4

Education For Survival
300 Mendham Road
Morristown, NJ 07960

FOCUS ON ENVIRONMENTAL EDUCATION (K-12)

1970. V. E. Vivian and T. J. Rillo. This book develops the theme of environmental education for the classroom into chapters offering practical assistance in planning, specific suggestions for programs and guidelines to evaluation. References include books, films and filmstrips. $2.00.

Curriculum Development Council for Southern New Jersey
Glassboro State College
Glassboro, NJ 08028

HOW CAN OUR PHYSICAL ENVIRONMENT BEST BE CONTROLLED AND DEVELOPED?

A collection of excerpts (231 pp.) and bibliography relating to the high school debate topic; compiled by the Legislative Reference Service, Library of Congress.

Three resolutions are that the Federal Government should: (1) finance and administer programs for air and water pollution, (2) establish economic penalties to control pollution, and (3) control use of chemicals which pollute.

Document No. 91-66. $1.00
Superintendent of Documents
U. S. Government Printing Office
Washington, D.C. 20402

MAN AND HIS ENVIRONMENT (K-12)

A comprehensive environmental education program for K-12. Grew from a program for New York City school children and includes introductory materials for teachers, sample lessons and follow-up activities. $5.00

High Rock Park Conservation Center
Nevada Avenue
Staten Island, NY 10306

NATIONAL WILDLIFE FEDERATION ENVIRONMENTAL DISCOVERY UNITS

Environmental discovery units, prepared by NWF and the Minnesota Environmental Sciences Foundation, Inc., are self-contained, inquiry oriented activities booklets which include charts, illustrations, materials list, bibliography and suggestions for additional activities. The basic concepts are presented simply, and may readily be integrated into existing classroom programs.

No.	Title	Grade Level	Price
79007	Plants in the Classroom	3-6	$1.50
79016	Vacant Lot Studies	5-9	$1.50
79025	Differences in Living Things	4-8	$1.00
79034	Shadows	1-8	$1.00
79043	Wind	3-6	$1.50
79052	Snow and Ice	1-6	$1.50
79061	Man's Habitat - The City	4-9	$1.50
79070	Fish and Water Temperature	4-9	$1.50
79089	Oaks, Acorns, Climate and Squirrels	1-6	$1.50
79105	Nature Hunt	K-1	$1.00
79098	Sampling Button Populations	3-9	$1.00
79114	The Rise and Fall of a Yeast Community	6-9	$1.00
79123	Genetic Variation	4-9	$1.50
79132	Soil	2-9	$1.50
79141	Tile Patterns and Graphs	1-2	$1.00
79150	Plant Puzzles	1-6	$1.50
79169	Brine Shrimp and Their Habitat	1-5	$1.50
79178	Nature's Part in Art	3-6	$1.50
79187	Change in a Small Ecosystem	5-9	$1.50
79212	Contour Mapping	4-9	$1.50
79203	Stream Profiles	4-9	$1.00
79221	Color and Change	K-2	$1.00
79230	Outdoor Fun for Students	1-12	$1.50
79196	Transect Studies	3-9	$1.50

National Wildlife Federation
Educational Servicing
1412 16th Street, N. W.
Washington, D.C. 20036

OUTDOOR ACTIVITIES FOR ENVIRONMENTAL STUDIES

A compilation of outdoor activities involving physical and mental skills using student made instruments and accessories. Activities include measuring windspeed, water clarity, distance, ground cover, soil absorption and compaction. No. 369. $1.35

The Instructor Publications, Inc.
P. O. Box 6108
Duluth, MN 55806

PEOPLE AND THEIR ENVIRONMENT (Grades 1-12)

A set of teacher's curriculum guides to conservation education in 8 volumes each costing $4.25:

General, Grades 1, 2, 3
General, Grades 4, 5, 6
Science, Grades 7, 8, 9
Social Studies, Grades 7, 8, 9
Social Studies, Grades 10, 11, 12
Home Economics, Grades 9, 10, 11, 12
Biology, all grades
Outdoor Laboratory, all grades

Doubleday & Co., Inc.
School and Library Division
Garden City, NY 11530

SELF-EARTH ETHIC (SEE) LEVEL ONE; LEVEL TWO "EVERYTHING IS TIED TO EVERYTHING ELSE"

The first in a series of 8 booklets whose authors, John M. Hart and Jesse M. Turner, describe as a life-centered approach to environmental education. A unique organizational scheme, and experimental and outdoor activities lead to the discovery of ecological concepts and their relationship to man and his activities. The program is flexible, integrative and imaginative and promises to be a beneficial enrichment system. $3.50

Interstate Printers and Publishers, Inc.
19-27 North Jackson Street
Danville, IL 61832

(Level Two of SEE became available as this manual went to press.)

WEB OF LIFE Teacher's Guides

To accompany student Web of Life series (see sourcebooks for students)

No. 1710	Ecology
No. 1711	Ecology -- Forests and Man
No. 1712	Ecology -- Deserts and Man
No. 1713	Ecology -- Grasslands and Man
No. 1714	Ecology -- The Mountains and Man

No. 1715	Ecology -- The Freshwaters and Man
No. 1716	Ecology -- The Oceans and Man
No. 1717	Ecology -- The Farm
No. 1718	Ecology -- The Suburbs
No. 1719	Ecology -- The City

Each guide is about 30 pages and is set up according to objectives, background information, questions, and follow-up activities. Cost 40¢ each (school price 30¢ each).

Benziger, Inc., Web of Life Information
866 Third Avenue
New York, NY 10022

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The following materials were compiled and evaluated by the ERIC Information Analysis Center for Science and Mathematics Education. Environmental education specialists have identified these as exemplary documents, worthy of note as curricular materials. To obtain complete information on the retrieval of reports, curriculum guides, journal articles, etc. on environmental education, write:

Science and Mathematics Education Analysis Center
The Ohio State University
Columbus, OH 43221

Request the report, ERIC: HOW TO USE IT FOR ENVIRONMENTAL EDUCATION.

A CURRICULUM ACTIVITIES GUIDE TO WATER POLLUTION AND ENVIRONMENTAL STUDIES

Tilton School Water Pollution Program
Tilton School
Tilton, NH 03276

ENVIRONMENTAL EDUCATION -- OBJECTIVES AND FIELD ACTIVITIES

Paducah Public Schools
Tenth and Clark Street,
Paducah, KY 42001

FIELD TRIP ACTIVITY SHEETS AND STUDENT FOLLOW-UP SHEETS SINGLE TOPIC CURRICULUM UNITS

Southeastern Pennsylvania Outdoor Education Center
Rose Tree Media School District (administrator)
P. O. Box 66
Lima, PA 19066

43 LESSONS AND TEACHER RESOURCES IN ENVIRONMENTAL EDUCATION FROM ENVIRONMENTAL SCIENCE CENTER

The lessons represent a great diversity in style and organization. The lessons are experience-oriented and based upon the need for techniques for looking at the environment in an organized way and of finding patterns and relationships in the data, materials, and observations which are collected.

1. Population Perspectives
2. Salts
3. Shadows
4. Color and Change
5. Soil
6. Auto, Environment, Values
7. Soil -- Acidity/Alkalinity
8. Minnows and Models
9. Stream Analysis
10. Plant Puzzles
11. Transect Activities I
12. Population Variation
13. Transect Activities II
14. Nature's Art
15. School Site Development
16. Brine Shrimp
17. The Cemetery as a Social Document
18. Variation Within a Species
19. Vacant Lot Studies
20. Population Growth
21. Stream Profiles
22. Button Bags
23. Contour Mapping
24. Tree Watching
25. Nature Hunt
26. Population Sampling
27. Habitat Study -- Transect Study
28. Give Earth a Chance
29. Water Quality
30. Liquids and More Liquids
31. Photography for Kids
32. Field Activities Package
33. Tubs of Tiles
34. Snow and Ice
35. Where Are the Animals
36. Succession in Micro-Aquaria
37. Outdoor Activities Collection
38. Managing Natural Resources
39. Plants in the Classroom
40. Micro-Climates
41. Wind
42. Man's Habitat -- The City
43. Squirrels, Acorns and Oak Trees

Environmental Science Center
5400 Glenwood Avenue
Golden Valley, MN 55422

INTERDISCIPLINARY OUTDOOR EDUCATION

Interdisciplinary Outdoor Education Program
Edward Osborn
Shoreline School District #412
Northeast 18th Street and 20th Avenue N. E.
Seattle, WA 98155

LAND-USE: CONCERN--CHALLENGE--COMMITMENT
WATER QUALITY MONITORING MANUAL
WATER--THE WASTE OF PLENTY

Conservation and Environmental Science Center
Dr. Eugene Vivian
Box 2230, R. D. #2
Browns Mills, NJ 08015

MAN AGAINST HIS ENVIRONMENT

State University of New York at Albany
State Education Department
Division of Educational Communications
Albany, NY 12224

MAN AND THE ENVIRONMENT--Student Text
MAN AND THE ENVIRONMENT--Teacher's Edition
MAN AND THE ENVIRONMENT--Laboratory Supplement

Educational Research Council of America
Published by: Houghton-Mifflin Co.
110 Tremont Street
Boston, MA 02116

NATUREALM

Naturealm
Richard Bartholomew
1308 Third Avenue
Duncansville, PA 16635

WESTERN COLORADO OUTDOOR NATURE CENTER ENVIRONMENTAL EDUCATION CURRICULUM

An environmental education curriculum guide to planned outdoor education experiences. The guide outlines environmental themes and appropriate behavioral objectives, as well as special interest topics for teachers. Although designed to be used in conjunction with the Colorado State University Nature Center, the material would be useful to any teacher seeking to incorporate environmental education into the school curriculum.

Howard D. Bruner, editor-director
Northern Colorado Nature Center
Colorado State University
Fort Collins, CO 80521

THE REGIONAL MARINE SCIENCE PROJECT OF THE CARTERET COUNTY PUBLIC SCHOOLS

Publications were designed for use as part of a curriculum series developed by the Regional Science Project of the Carteret County Public Schools, financed primarily by ESEA TITLE III. All materials take an ecological approach to nature, stressing the ties between culture, economy and resource use. Field work is an integral part of the curriculum. Publications are distributed at cost to interested school systems. Most are designed for use on the central eastern seaboard.

1. Marine Science Film Catalogue
2. The Major Natural Communities of the Carolina Coast
3. The Field Experience
4. The Regional Marine Science Project of the Carteret County, NC Public Schools
5. Summer Science by the Sea
6. A Day with Don at Cape Lookout Seashore
7. Don Explores a Tidal Flat
8. How Sea Animals Live
9. Living Communities of the Seashore
10. The Ocean and Modern Man
11. Salt Marsh, Sound and Sea Beach
12. The Sea and Its Boundaries
13. The Field Approach to Coastal Ecology
14. Experiments with Sea Water
15. North Carolina: Our Role at the Edge of the Sea
16. Marine Ecology
17. Marine Science
18. A Tour of Mudflat Town
19. The Sea and Modern Man
20. Creating Effective Field Experiences for Coastal Schools

Will Hon, director
Regional Marine Science Project
Carteret County Public Schools
Beaufort, NC 28516

BIBLIOGRAPHIES AND CATALOGUES

CONSERVATION EDUCATION BIBLIOGRAPHY

Curriculum Research and Development Center
Indiana State University
Terre Haute, IN 47808

CONSERVATION EDUCATION: A SELECTED BIBLIOGRAPHY AND SUPPLEMENT

A very useful bibliography of selected and annotated materials, primarily books, organized as to subject matter, and indexed according to subject matter and author. The reading level is specified, and basic collections for the school are outlined. In addition, subsections include "Tools For Teachers" and "Vocational Materials." A must for school librarians. $3.25

Interstate Printers & Publishers, Inc.
Danville, IL 61832

ENVIRONMENTAL INFORMATION: SOURCE GUIDE AND BIBLIOGRAPHY

A collection of various free and inexpensive materials from business, industry, and organizations and agencies concerned with problems of air and water pollution, wildlife preservation, population control, etc.

Minnesota Environmental Sciences
Foundation, Inc.
5400 Glenwood Avenue
Minneapolis, MN 55422

FREE AND INEXPENSIVE MATERIALS FOR TEACHING CONSERVATION

An annotated bibliography of free and inexpensive materials for teaching conservation of forests, soils and water, wildlife, and minerals. The series was prepared as companion volumes to the curriculum guides prepared by and for the teachers of Louisiana. Although most relevant to the southeastern United States, there is much of a general nature useful to the environmental educator.

North Louisiana Supplementary Education Center
Northwestern State College
Natchitoches, LA 71457

SCIENCE FOR SOCIETY-A BIBLIOGRAPHY

An invaluable source of literature references. Covers books and articles (popular and scientific) with the largest fraction of the book devoted to environmental aspects of science. It is well classified and probably the most comprehensive bibliography readily available. Single copies $1, 10 or more copies at a time $.75 each.

Commission on Science Education
American Assn. for the Advancement of Science
1515 Massachusetts Avenue, N.W.
Washington, DC 20005

CATALOGUES

AIDS TO LEARNING

Aids to Learning is available from the American Forest Institute and describes free and inexpensive materials including such things as charts, booklets, audio tapes, simulation games, etc. Write:

American Forest Institute
16169 Massachusetts Avenue, N.W.
Washington, DC 20036

AUDUBON AIDS IN NATURAL SCIENCE

A guide to the study programs, nature bulletins, charts, slides, conservation fact sheets, and assorted aids prepared by the National Audubon Society.

Educational Services
National Audubon Society
1130 Fifth Avenue
New York, NY 10028

ENVIRONMENTAL AND OUTDOOR EDUCATION MATERIALS COMPANY

A good source of environmental and outdoor education materials. The materials are described, and the listing is comprehensive enough to qualify as a bibliography in itself. Catalogue, 50¢.

Environmental & Outdoor Education Materials Company
Dowling, MI 49050

REED & SONS, OUTDOOR EDUCATION SPECIALISTS

Free catalogue which includes books, learning aids, and equipment.

Reed & Sons
Box 150, Route #2
Perrysville, OH 44864

Other Sources of Information:

CONSERVATION TOOLS FOR EDUCATORS

HELP FOR ENVIRONMENTAL EDUCATION

Hoosier National Forest
1615 "J" Street
Bedford, IN 47421

CONSULTING SERVICES AND WORKSHOPS

Joe E. Wright
Environmental Education Consultant
Division of Curriculum
Indiana State Dept. of Public Instruction
Room 108, State Office Building
Indianapolis, IN 46204

ENVIRONMENTAL EDUCATION MATERIALS AND GUIDELINES

Environmental Education
Office of Priority Management
Office of Education
400 Maryland Avenue, S.W.
Washington, DC 20202

FREE AND INEXPENSIVE ENVIRONMENTAL EDUCATION RESOURCE MATERIALS FOR THE ELEMENTARY AND SECONDARY TEACHER

John Moody
Division of Education
Indiana University - Southeast
Warder Park, P.O. Box 459
Jeffersonville, IN 47130

LIST OF MATERIALS

Division of Health Education
Indiana State Board of Health
1330 West Michigan Street
Indianapolis, IN 46202

REPRINTS

American Association for the Advancement of Science Reprints

AAAS Reprints
Dept. RA-3
1515 Massachusetts Avenue NW
Washington, D.C. 20004

The following reprints were originally published in Science and are available for 25¢ each. Be sure to specify number and title when ordering.

27. Coale: Man and His Environment
28. Crowe: The Tragedy of the Commons Revisited
29. Ehrlich and Holdren: Impact of Population Growth
30. Eipper: Pollution Problems, Resource Policy, and the Scientist
31. Eisenbud: Environmental Protection in the City of New York
32. Goldman: The Convergence on Environmental Disruption
33. Hardin: The Tragedy of the Commons
34. Hare: How Should We Treat Environment?
35. Harrison et al: Systems Studies of DDT Transport
36. Higginson: International Research: Its Role in Environmental Biology
37. Houston: Ecosystems of National Parks
38. Hubschman: Lake Erie: Pollution Abatement, Then What?
39. Lave and Seskin: Air Pollution and Human Health
40. Lotspeich: Water Pollution in Alaska: Present and Future
41. Moncrief: The Cultural Basis for Our Environmental Crisis
42. Odum: The Strategy of Ecosystem Development
43. Orians and Pfeiffer: Ecological Effects of the War in Vietnam
44. Orleans and Suttmeier: The Mao Ethic and Environmental Quality
45. Russel and Landsberg: International Environmental Problems - A Taxonomy
46. Shinnar: Systems Approach for Reducing Car Pollution
47. Solow: The Economists Approach to Pollution and Its Control
48. Spilhaus: Ecolibrium
49. Tschirley: Defoliation in Vietnam
50. White: The Historical Roots of Our Ecological Crisis
51. Wolman: The Nation's Rivers
52. Woodwell: DDT in the Biosphere: Where Does It Go?
53. Woodwell: Effects of Pollution on the Structure and Physiology of Ecosystems

National Geographic Society, Washington, D.C. 20036

"Our Ecological Crisis" is a 58-page article that appeared in the December 1970 National Geographic. It contains also the chart "How Man Pollutes His World." A reasonably good popular overview of environmental problems with excellent pictures. Although not available as a separate reprint, the whole December 1970 issue can be purchased with the chart for $1.00

REPRINTS Cont.

Scientific American Offprints

W. H. Freeman and Company
660 Market Street
San Francisco, California 94104

The following offprints were originally published in Scientific American and are available for 25¢ each. Be sure to specify number and title when ordering.

114. Went: Ecology of Desert Plants
144. Cole: The Ecosphere
159. Woodwell: The Ecological Effects of Radiation
192. Wynne-Edwards: Population Control in Animals
1056. Powers & Robertson: The Aging Great Lakes
1066. Woodwell: Toxic Substances and Ecological Cycles
1099. Cooper: The Ecology of Fire
1135. Clark: Thermal Pollution and Aquatic Life
1138. Edwards: Soil Pollutants and Soil Animals
1188. Hutchinson: The Biosphere
1189. Oort: The Energy Cycle of the Earth
1190. Woodwell: The Energy Cycle of the Biosphere
1191. Penman: The Water Cycle
1192. Cloud & Gibor: The Oxygen Cycle
1193. Bolin: The Carbon Cycle
1194. Delwiche: The Nitrogen Cycle
1195. Deevey: Mineral Cycles
1196. Brown: Human Food Production as a Process in the Biosphere
1197. Singer: Human Energy Production in the Biosphere
1198. Brown: Human Materials Production in the Biosphere
1202. Bormann & Likens: Nutrient Cycles of an Ecosystem
1211. Chisolm: Lead Poisoning
1215. Lowry: The Climate of Cities
1221. Goldwater: Mercury in the Environment
612. McDermott: Air Pollution and Public Health
618. Haagen-Smit: The Control of Air Pollution
645. Davis: Population
646. Glazer: The Renewal of Cities
659. Davis: The Urbanization of the Human Population
841. Starr: The General Circulation of the Atmosphere
894. Newell: Global Circulation of Atmospheric Pollutants

Grade Teacher, Reprint Department., 23 Leroy Avenue, Darien, CT 06820

Ecology: Four Concepts You Must Teach. #90193. 40¢
Why Do We Conserve Our Resources? #90391. 40¢
Pollution -- A Teaching and Action Program (3 activity units for middle and upper grades) #91001. $2.95

GRAPHICS

ADAPTATIONS TO WATER ENVIRONMENTS: PROTECTION

Beautiful study prints of various creatures found in water environments. Each print provides background information and questions on the reverse side.

BFA Educational Media
2211 Michigan Avenue
Santa Monica, CA 90404

LIVING THINGS SERIES: ALIKE AND DIFFERENT

Study prints of toad, salamander, black widow spider, snail, praying mantis, ant, gopher, snake, sea urchin, tomato worm, horned lizard, earthworm, sea anemone with questions and background information on the reverse side of each.

BFA Educational Media
(see above)

DISCOVERING OUR ENVIRONMENT (grades 3 to 6)

Attractive colorful photographs in four units of 10 prints each present an up-to-date introduction to the biosphere. The series includes: What Is Our Environment; Living Things Use the Environment; Man Misuses the Environment; Restoring and Conserving the Environment. The text includes a description of each print, suggests activities, and provides additional background information for the teacher. A teacher's guide and the toss game "Survival" are included. Series (#F130), $58; $15 each unit; $3 each game.

Coronet
65 E. South Water Street
Chicago, IL 60601

EPA CHARTS

A set of charts is available from EPA on environmental topics. Each large wall chart has a color picture with an inscription. Ask for wall posters.

Environmental Protection Agency
1 North Wacker Drive
Chicago, IL 60606

GRADE TEACHER CHARTS

Pond Life	#90002	70¢
Animal Tracks	90004	70¢
Weather Fronts	90005	70¢
Oceanography	90009	70¢
Trees	90011	70¢

Grade Teacher/Reprint Dept.
23 Loroy Avenue
Darien, CT 06820

INSTRUCTOR CHARTS

Primary science concepts chart		
Plants	#661	$3.50
Animals	#665	$3.50
Science for middle-upper grades		
Plants	#584	$3.50
Air and weather	#585	$3.50
Oceanology	#590	$3.50
Ecology posters	#750	$3.50
Eco-problems posters	#753	$3.50

Instructor Curriculum Materials
P.O. Box 6108
Duluth, MN 55806

ECOLOGY POSTER CARDS (elementary)

Set of 20 two-color photographs (11 1/4 x 14") depicting man's relationship to his environment (air, water, land, urban-areas, plants) and the imbalances created. Explanatory notes on reverse. $3

Milton Bradley Co.
Springfield, MA 01101

HOW MAN POLLUTES HIS WORLD

A 42 x 29" chart showing sources and effects of pollution. See also "Our Ecological Crisis" under reprints section. Available to schools when 50 or more are purchased at a time at $.55 each.

National Geographic Society
Washington, DC 20036

AIR POLLUTION CHART

A 28 x 22 1/2" color chart with the central illustration depicting major sources of air pollution. Tabular and pictorial information on dispersion, major pollutants, physical data, atmospheric profile and effects on the human body. $2

Roy G. Scarfo, Inc.
P.O. Box 217
Thorndale, PA 19372

OCEANOGRAPHY CHART

A 39 x 29" color chart including information and illustrations on tides, profiles, surface currents, theory of continental drift, ocean floor and ocean basin definitions and features. $3.50

Scarfo
(see above)

WATER POLLUTION CHART

A 28 x 22 1/2" chart with a central illustration showing water management and sources of pollution. Other information includes aquatic food chain, physical data, mercury cycle, drainage basins, and major pollutants. $2.50

Scarfo
(see above)

ECOLOGICAL COMMUNITIES AND ECOSYSTEMS

A series of posters depicting and defining the structure of various communities in nature and their relationship to abiotic factors.

J. Weston Walch
Portland, ME 04104

Educational Materials Available

SIMULATION GAMES

INDIAN VALLEY FOREST MANAGEMENT (grades 7 to 12)

Indian Valley is an educational gaming technique on environmental management. It deals with a forested valley (with lakes, streams, a town and land areas as forest, burned and clearcut) and how to manage the resources to achieve the highest possible yield of long term values from the valley. A class is separated into six teams as follows: parks and recreation, timber resources, fish and game, fire protection, water resources, and multiple use committees. Each team develops projects for development with roads and facilities and is heard before the multiple use committee who develops a master plan. Maps and instructions are reproducible. Single copies free from:

American Forest Institute
1619 Massachusetts Avenue, N.W.
Washington, DC 20036

MAN IN HIS ENVIRONMENT (grades 4 and up)

A classroom ecology kit to help students understand major ecological principles. Separated into two simulations: Rescue in Space, which relates that resources are limited, must be used wisely and reused when possible (the initial playing time is 40 to 60 minutes) and Make Your Own World, which shows that elements of the environment are interdependent (this requires one to five periods). Although designed for a class of 30, it can be played effectively with 10 to 70 pupils, and scheduling is flexible. Aids in awareness, promotes debate and decision making and fosters an appreciation for the democratic process. Available to classroom teachers only at no cost from your local Coca-Cola bottling company.

NO TIME TO WASTE (grades 3 to 6)

Part of a multimedia kit, this game is a rummy-type card game to reinforce knowledge of cycles. Cards represent components of the natural environment (producers, consumers, sun-air-earth-water) and pollution cards which break the chains formed by students with the natural environment cards. An entire class can play. Available as an entire kit only (includes filmstrip, record, game manual and handbook). $7.50

Office of Environmental Affairs
Continental Can Co.
633 Third Avenue
New York, NY 10017

RECYCLING RESOURCES (grades 7 to 9)

Students determine the future of their environment with this pollution simulation game by playing roles as mayors or manufacturers, e.g. They discover that things are not as simple as they first appear and that de-pollution has a cost. They take actions, change laws, etc. Available as an entire multimedia kit (including record, filmstrip, game, manual and handbook). $12.50

Continental Can Co.
(see above)

ATTITUDES ABOUT THE ENVIRONMENT (Graphigames No. 2: grades 5 to 8)

A versatile game, it uses basic social science techniques (survey methods, hypothesis and data analysis) and explores value issues from an objective data base. Activities last 3 to 5 periods. Game includes poster-size graphs, 90 players' forms and teaching guide. $3.75

Education Ventures, Inc.
209 Court Street
Middletown, CT 06457

NEW HIGHWAY (Community Decisions Game No. 1: grades 5 to 8)

and

OPEN SPACE (Community Decisions Game No. 2: grades 5 to 8)

The class (simulated community) is divided into six interest groups -- public officials, small businessmen, manufacturers, consumers A, B, and C. Introduces the socio-political concepts conflicts of value, conflicts of interest and consensus. Designed to help students anticipate, understand and deal with community conflicts. The games are flexible (3 to 6 periods) and encourage innovation and enrichment. Each game $4.95.

Education Ventures
(see above)

LAND USE (grades 7 to 12)

Elicits conflict between preserving resources and quality housing. Based upon a housing development simulation and the participants discover the alternative of cluster zoning. Players design a community with ponds, recreation areas, highways and houses. $1.95

Education Ventures
(see above)

SACRIFICE

Creates attitude of environmental awareness and human relations through group decision making. Players form teams of interest groups (public utility executives, consumer-voters, manufacturers, etc.) and are given a set of problems to solve with each group defending its own interest. This is a disposable game (can only be played once) but is applicable for 10 to 100 students who experience conflicts of value, conflicts of interest and consensus. $4.95

Educational Ventures
(see above)

BALDICER

Simulates food production and distribution problems on a global scale. Can be played by 10 to 20 students. BALDICER (an acronym for balanced diet certificate) stimulates interest in the complexities of feeding the population of the world. $25

John Knox Press
Box 1176
Richmond, VA 23209

NATURAL RESOURCES CONCEPT PACK (elementary)

Contains two units: Using Natural Resources and Conserving Natural Resources. Games allow discovery and development of resources as well as how to protect them from exploitation and pollution with proper conservation techniques. Each unit also includes 12 poster cards (11 1/4 x 14"). $7.50

Milton Bradley Comp.
Springfield, MA 01101

EXTINCTION-THE GAME OF ECOLOGY (grades 7 to 12)

Extinction is a board game for 2 to 4 players, which simulates natural and man-caused ecological events. Survival of a species is the game's object. Introduces genetic and ecological concepts including fitness, reproduction, migration, competition and predation. A versatile ecology game using an explicit scientific-biological approach to population growth and survival. $11.95

Sinauer Associates, Inc.
20 Second Street
Stamford, CT 06905

W.A.L.R.U.S.: WATER AND LAND RESOURCE UTILIZATION SIMULATION (grades 9 and up)

Students representing various economic, political and demographic interests experience the impact of public and private decisions on water pollution and land use. The kit comes with all materials necessary to play. $75

Urbex Affiliates
474 Thurston Road
Rochester, NY 14619

C.L.U.G.: COMMUNITY LAND USE GAME (grades 9 and up)

The community land use game is a board game for three to five teams, which abstracts a small number of basic characteristics of cities and their surrounding territories on the basis of which players build, operate and maintain their own community. A complex game that permits modifications and simulates the conditions that determine land use parameters. $75

Urbex Affiliates
(see above)

CONDUCTING PLANNING EXERCISES (grades 8 to 12)

Students plan and propose alternative solutions to complex social problems. Exercises are designed around issues such as student-teacher communication, drug abuse and family life education. Activities include various combinations of debate, competition, cooperation, and simulation. Students increase problem-solving and decision-making skills and learn how to cope with divergent viewpoints, often coupled with strong emotional overtones. The exercise accomodates 16 to 32 students. The "how-to-do-it" manual includes an explanation of procedures, sample problem statements, background information points of view, and bibliographies for issues. PLN 200 Manual, $4

Instructional Development Corp.
P.O. Box 805
Salem, OR 97304

POLLUTION: NEGOTIATING A CLEAN ENVIRONMENT (grades 7 to 12 and adult)

Selected problems of air, water, land and visual pollution are dealt with by participants in negotiating for a cleaner environment. The exercise permits participants to cope with the trade-offs between personal or corporate goals and environmental quality. The game may be played with as few as four persons or adapted for as many as 32. Materials include instructor's manual, role cards, 30 issue and opinion poll cards, voting symbols, scoring charts and markers, and overhead transparencies. $22.50

Instructional Development Corp.
(see above)

BALANCE (grades 4, 5, 6)

Like Ecopolis this is an activities oriented game, "a simulation of four families caught in ecological dilemmas." Investigates the ecosystem idea, attitudes, pollution, population and alternatives. Examines economic responsibilities, trade-offs, commitment. Skills include Reader's Guide, literature search, discussion, interviewing and role-playing. Set up for 15 periods; makes good use of existing materials. $10/kit (includes 35 student guides and one teacher guide)

Interact
P.O. Box 262
Lakeside, CA 92040

ECOPOLIS (grades 4, 5, 6)

A flexible game (about 15 1-hour sessions) that simulates a community struggling to solve ecological problems. Designed to get across the ecosystem concept, how man's attitudes shape the environment and population problems. Helps develop an appreciation for balance, interest groups, interaction and civic responsibility. Skills include essay, notes, debate and role playing. Game relies on existing classroom resources and contains reproducible materials -- allows innovation. $10/kit (includes 35 student guides and one teacher guide)

Interact
(see above)

NEW TOWN (grades 7 to 12)

New Town uses 3 to 8 players and can be played in five versions of complexity depending upon the grade level. The game lasts 45 minutes to 3 hours (depending upon the version played). New Town was developed according to the principles of modern game theory and sets out to build a new town 25 miles from a major city. It takes into account basic economic, environmental, political and social factors in building schools and sewage plants, taxing, managing flood plains, using prime agricultural land for urban development or determining solutions for air, water and noise pollution. (A documented card deck is also available for using the game on a computer.) Kit I (10 students) $16
Kit II (20 students) $28

Harwell Associates, Inc.
Box 95
Convent Stations, NJ 07961

THE POLLUTION GAME (grades 3 to 12)

Keyed around an air and water pollution index, this pollution game simulates environmental contamination and can be played in 1 or 2 class periods by teams of five members. Students design strategies, make decisions, develop a feel for changing technology and social behavior and understand how a community functions. "Pollution" is easy to learn, simple to play and is won by the team having the lowest air and water pollution index. $12 (school price $9)

Houghton Mifflin
Geneva, IL 60134

THE PLANET MANAGEMENT GAME (grades 6 to 12)

Decisions are made by players (2 to 12 at a time) that affect the quality of life on the hypothetical planet Clarion. Factors such as income, food, population and environmental indices are varied and a "data bank" provides the results. The game is actually a computer designed simulation of existing earth conditions and is based upon real-world historical and statistical information. $16 (school price $12)

Houghton Mifflin
(see above)

LITTERBUG (grades K to 4)

A game for early learners based on the idea that cleaning up the environment is its own reward. 2 to 4 players. $5

Urban Systems
1033 Mass. Ave.
Cambridge, ME 02138

DIRTY WATER (grades 3 to adult)

Students assume the role of water pollution control officials faced with the task of keeping local bodies of water in a normal state of ecological balance. Many environmental problems are considered in the process of managing water resources. 2 to 4 players. $10

Urban Systems
(see above)

CLEAN WATER (grades 3 to adult)

The economic version of "Dirty Water." The same basic game only a bit smaller with condensed background material. 2 to 4 players. $7

Urban Systems
(see above)

SMOG (grades 9 to adult)

Each player assumes the role of an elected official responsible for air quality. Students become acquainted with many of the complex problems a local administrator must deal with in controlling the quality of the air. 2 to 4 players. $11

Urban Systems
(see above)

ECOLOGY (grades 5 to adult)

A clever game that stresses the importance of bringing population, technology, and the environment in which man lives into a workable "balance." 2 to 4 players. $10

Urban Systems
(see above)

POPULATION (grades 7 to adult)

Students must make decisions about industrial growth, medical advances, international relations, agricultural improvements and disasters, education, internal and international economics, etc., and their effects upon population growth and orderly development. 2 to 6 players. $10

Urban Systems
(see above)

PREDATOR PREY (grades 3 to adult)

Students are provided with a comprehensive view of predator-prey and competitive relationships of animals in an ecosystem. A companion booklet contains background information on food chains, food webs, animal population sampling methods, biomass, energy pyramids, and other ecological concepts. $6

Urban Systems
(see above)

KITS AND LABORATORIES

QUALITATIVE INTRODUCTION TO WATER POLLUTION KIT (H. S. science)

An excellent introduction to water testing. Reliable qualitative tests to identify low concentrations of common pollutants. There are 11 tests in the kit including copper, cyanide, iron, nitrates, phosphates and ammonia. It is completely self contained with glassware and chemicals sufficient for 50 students working 12 at a time. Instructions and background information are provided. Cat No. 84-1345. $34.95

Carolina Biological Supply Co.
Burlington, NC 27215

WATER POLLUTION LABORATORY (grades 4 to 8)

Although a multimedia kit, the main emphasis is a laboratory approach. Twenty-one experiments center around water (nature of, pollution, cycling, demands, testing, treating and solving problems). Filmstrips and cassettes are included on "Earth-Water and Man," "Clean Water-a Vanishing Resource" and "A River's Journey." Can be used in either science or social studies subject areas or as an interdisciplinary program. Equipment and supplies enough for two complete classes and replacements can be ordered for the disposables. Complete Program (No. 11-02) $225

Educational Progress Corp.
8538 East 41st Street
Tulsa, OK 74145

POLLUTION TEST KIT (grades 2 to 8)

Kit contains 40 individual experiments for air, soil, and water pollution. Appropriate glassware, chemicals and charts are included as well as a manual. $9.95

Envirco, Inc.
801 Skokie Blvd.
Northbrook, IL 60062

HACH CHEMICAL CO.
Box 907
Ames, IA 50010

A range of water-study kits available from $3 to $250.
"Water-Test Kit Catalog" is free.

KOSLOW TRACE KITS

Practical, inexpensive kits provide a way to make immediate checks for heavy trace metals in the environment based on simple, chemical color tests. The kits contain necessary labware, reagents, and complete instructions. Kits could be used for class or individual projects. No specialized training in chemical technique is required. Kits available include: Arsenic No. 1233, $16.50, Lead No. 1282, $19.50; Mercury No. 1280, $19.50; Cadmium No. 1248, $25.00.

Koslow Scientific Co.
7800 River Road
North Bergen, NJ 07040

La MOTTE CHEMICAL PRODUCTS CO. (H. S. science)

Chestertown, MD 21620

This firm handles a broad line of science equipment applicable for high school science classes. In addition to handbooks and reagent systems, La Motte has a large array of equipment for testing, sampling and demonstration in the field of water pollution.

INVESTIGATIONS IN ECOLOGY, LOOKING INTO EARTH'S LIFE SYSTEMS AND MAN'S IMPACT ON ENVIRONMENT

This kit provides a sound approach to teaching about the environment through 70 handy skill-cards, each containing a complete lesson. The teacher can move from unit to unit as applicable by using the enclosed Guide to Learning. For upper elementary and high school grades. $9.95

Charles E. Merrill Co.
1300 Alum Creek Drive
Columbus, OH 43216

NITRATE KIT

A kit to test nitrate in water. $1.00

Michigan State University
Soil Testing Laboratory
East Lansing, MI 48823

ECOLOGY AND YOU (grades 9 to adult)

An assembly of scientific testing materials designed to detect and measure the amounts and effects of sources of air, earth, and water pollution. The teacher's manual portrays ways in which the individual can help in solving pollution problems. $9.95

Replogle Globes
Educational Division
1901 North Narragansett Avenue
Chicago, IL 60639

IS THE WATER CLEAN? (ages 8 to adult)

What pollutes drinking water? The Ecokit includes two experiments and an information booklet which give students an understanding of the risk of contamination caused by increasing industrial and domestic wastes. $3

Urban Systems
1033 Mass. Avenue
Cambridge, MA 02138

WHAT LIVES IN THE WATER? (ages 8 to adult)

Students study plankton, nutrients, the interrelationship of phytoplankton and zooplankton and the effects of over-eutrophication of the water. An experiment on the dependence of algae upon nutrients and a plankton net that allows students to start their own plankton aquarium, are included in the kit. $3

Urban Systems
(see above)

PLANT ANIMAL SOIL (ages 14 to adult)

Environment Test Set One is actually a collection of three ecology kits and one grow kit brought together to give students a comprehensive overview of the interrelations between plants, animals and the soil. The 56-page booklet includes information from "What Moves Life?", "Predator Prey" and "Life From Death," while materials are provided for nearly all of the related experiments. $10

Urban Systems
(see above)

AIR & WATER (ages 14 to adult)

Examining the many aspects of air and water quality, Environment Test Set Two provides material for 10 different experiments and a 45-page booklet which give students a thorough understanding of the magnitude and complexities of today's environmental crisis. $10

Urban Systems
(see above)

AIR ECOTEST KIT (ages 12 to adult)

Students learn how factories, automobiles, etc, are polluting the air in their neighborhood. The kit contains filter papers, chemical and scientific apparatus for three complete tests of air quality: particles in the air, oil residues and sulphur dioxide. Each test may be run several times for comparative purposes. $3

Urban Systems
(see above)

CAN I DRINK THE WATER? (ages 12 to adult)

Four carefully planned experiments and a 20-page booklet answer some of the questions most often asked about water. The importance of clean water in the environment is stressed. $6

Urban Systems
(see above)

WATER ECOTEST KIT (ages 12 to adult)

A compact kit that supplies chemicals, test papers and scientific apparatus to test tap water and samples from nearby rivers, lakes or ponds. By testing the acidity of water, students discover how common household cleaners or even foods can pollute the water. A complete test of hardness shows how minerals in the water from natural or industrial sources can be troublesome in the environment. $3

Urban Systems
(see above)

SOIL ECOTEST KIT (ages 12 to adult)

Both acidity and nitrate level of the soil can be tested with this kit. Plant absorption of minerals and the effects on seedlings by pollutants in the soil are demonstrated. $3

Urban Systems
(see above)

POLLUTION DETECTION KIT (ages 14 to adult)

The kit includes all chemicals and equipment necessary to perform simple but accurate tests for ammonium, copper, cyanide, hydrogen, sulfide, lead, mercury, nitrite, oil, pH, bacteria and sulfur dioxide. The easy-to-follow booklet helps students trace the sources of pollution to local industries or upstream factories and refineries, chart their findings and report pollution to local agencies. In addition, there are experiments that let students simulate the effects of pollution in the classroom. $10

Urban Systems
(see above)

THE WATER TEST KIT (ages 14 to adult)

Five different tests provide students with facts about water quality in the community. Chemicals, apparatus, background information and test instructions let students test for: dissolved oxygen, hardness, chlorides, phosphates and hydrogen sulfide. $12

Urban Systems
(see above)

ENVIRONMENTAL FILMS

Film Listings Available

A Compilation of Materials for Environmental Education. Descriptions, sources and grade level for about 100 films. Although incomplete, the list is useful and informative. Single copies free. NEA Environmental Education Project, NEA.

Environmental Education Bibliography (Office of Environmental Education, USOE, HEW). Selected films are described under the following sections of the bibliography which appear elsewhere in this manual:

Pre-School - Grade 3
Grades 4-6
Grades 7-9
Grades 10-12

The Environment Film Review. Published annually by the Environment Information Center, Inc., this guide is primarily a user-oriented publication which evaluates and identifies films according to general and specific subject terms. A helpful cross-reference system locates films by subject, sponsor, and title. Films for K through adult are reviewed. Price: $20. From Environment Information Center, Inc., Film Reference Dept., 124 East 39th St., New York, NY 10016.

EPIE Educational Product Report: Environmental Education Materials. A 96-page guide evaluating films (and other materials) for grades K-12. Price: $7. From EPIE Institute, 386 Park Avenue S, New York, NY 10017.

A Film Guide to the Environmental Crisis. This guide was compiled by the audio-visual editor of Ecology Today as a special supplement (pages 25-40) to the September 1971 issue. About 90 films are described and classified as to: Air, Water, Overview, Waste, Population, Cities, Machines, Noise, Nature. In addition to descriptions, running times and source are given but no indication as to age orientation nor rental costs. The guide can be purchased for 60¢ each from Ecology Today, Box 180, West Mystic, CT 06388.

A List of Environmental Films. Compiled by the Cooperative Science Education Center in Oak Ridge, TN, it is probably the most comprehensive list available for environmentally related films. Except that grade level applicability was not evaluated, all other information is included. The sources include government and academic as well as commercial publishers. Films are classified under the following subject areas: Air Quality, Ecology (biomes, communities, waterlife), Land Usage, Noise Quality, Pesticides, Population, Water Quality and Wilderness (conservation). Many of the films are available for loan, at no cost.

Educational Materials Available

TRANSPARENCIES

ECOLOGY (grades 4 to 12)

The objective of this series is to illustrate harmony and balance in nature and the effects of man's activities as they endanger this balance. 22 overhead transparencies with overlays. $11

Creative Visuals
Box 1911
Big Spring, TX 79720

ECOSYSTEM NUTRIENT CYCLES (grades 1 to 12)

A set of 6 transparencies presents simplified, accurate diagrams of nutrient and biogeochemical cycles. A lesson plan is included. $11.95

Hester and Associates
11422 Harry Hines, #212
Dallas, TX 75229

ECOLOGY (ungraded elementary through beginning biology)

A book containing 12 overlay transparencies, guide and four spirit masters. Presents an excellent review of basic ecological concepts: Physical environment, food webs, communities, succession and biomes. Full color transparencies provide enrichment or summary for other programs. Would augment SCIS nicely. $6.95

Milliken Publishing Co.
611 Olive Street
St. Louis, MO 63101

LET'S TOUR MEGALOPOLIS (ungraded 5 to 8)

With emphasis on the megalopolis of the Northeast, this program generalizes about large urban centers by characterizing growth patterns, governments, transportation, water, community services, industrial activities, economics and industrial and agricultural activities. A useful adjunct for units on cities. Contains 12 color overlay transparencies, 6 spirit masters and a teaching guide. $6.95

Milliken Publishing Co.
(see above)

LANSFORD TRANSPARENCY SETS

Population Problems

Ten Transparencies dealing with population problems emphasizing those in the U.S. No. T50. $49.95

Our Troubled Land

Maps and tables showing population concentrations, resource consumption, land use, waste, conservation problems. 10 Transparencies. No. R102. $49.95

The 1970 Census of Population

Population trends in the U.S. based on final census counts (12 transparencies). No. 5101. $59.95

Today and Tomorrow in Air Pollution

Set of 18 overlays on sources, levels, predictions and controls related to air pollution. No. S113. $79.95

Land Utilization and Erosion

Use, characteristics, maps, conservation, capability and erosion related to soils. (10 overlays) No. A110. $49.95

Water and Its Use

Demands, use, location and administration of water resources. (10 transparencies). No. A1.06. $49.95

Product Development and Ecology

Purposes, nature, quality, etc. of products and technological and ecological constraints of development. (15 transparencies) No. RS101. $74.95

The Third Pollution-Noise in the U.S.

Ratings, levels, sources and effects of noise. (10 transparencies). No. A108. $49.95

Succession

A series of 10 diagrams depicting the transition of communities. No. TH101. $49.95

Population Dynamics

Set of 12 transparencies showing basic growth forms of populations and interactions with other components of the environment. No. TH105. $59.95

Fresh Water Biology

Seven overlays illustrating the major characteristics of north-temperate fresh water lakes. No. TH103. $34.95

Lansford Publishing Co.
2516 Lansford Avenue
San Jose, CA 95125

ECOLOGY AND THE STUDY OF POLLUTION (grades 4 to 6)

Twelve, 8 1/2" by 11" unmounted, color transparencies with spirit master worksheets and teacher's guide. $6.95

Science Teacher Transparency Workbooks

MAN AND HIS ENVIRONMENT (grades 5 to 8)

Twelve, 8 1/2" by 11" unmounted, color transparencies with spirit master worksheets and teachers guide. $6.95

Science Teacher Transparency Workbooks

MULTIMEDIA

POLLUTANTS: AN AMERICAN FAMILY (grades 6 to 12)

An examination of how the members of a family contribute to the pollution of the environment, and the effort necessary to reduce the problem. The six strips, with disc or cassette include: Series: $85; $20 each.

Son
Daughter
Mother
Father
Grandmother
Grandfather

AIDS

ECOLOGY (grades 9 to 12)

The earth's present condition is presented through visuals and sound and the question of its future condition at the hand of man is examined. one strip with one disc and teacher's manual. $17.50

Argus Communications
3505 N. Ashland Avenue
Chicago, IL 60657

ECOLOGY - OUR CHALLENGE (grades 4 to 6) (Educable mentally retarded)

A series of 8 strips with teacher's guide and student activity sheets designed to present interrelationships of plants and animals and their environments to the educable mentally retarded student. #A5017G-24G, $64.95. The series includes:

Lifes Basic 3
Chain of Life
Ecology of Seashore Community
Ecology of Grassland Community
Ecology of Forests and Mountaintop Community
Ecology of Water and Wetlands Community
Conservation: Man's Task

AVID Corp.
10 Tripps Lane
E. Providence, RI 02914

MAN AND HIS EARTH (grades 4 to 6)

Geographic features, man's use of them and the effects of such use are examined. Student activity sheets and a teacher's guide are part of the kit. 8 strips, captioned, (#A5009G-16G) $64.95. Titles include:

Oceans
Man's Use of the Oceans
Rivers on the Move
Man's Use of Rivers
Deserts
Man's Use of Deserts

Mountains of the World
Man's Use of the Mountains

AVID
(see above)

ECOLOGY AND ENVIRONMENT SERIES

The program consists of three packages, one for each curriculum level: primary; middle; high school. The focus is on awareness of life communities and man's role in and influence on communities.

Primary Grades - $25

Colored Filmstrips

1. Wildlife Conservation
2. Story of Soil
3. Water in Our Lives
4. Plants: The Basic Food of Life
5. Seeds
6. What is a Mammal
7. How Animals Help Us
8. How We Use Trees
9. Animal Homes
10. Backyard Community

Books

Environmental Handbook by Garret DeBell
The Frail Ocean by Wesley Marx
Defoliation by George Wald
Teacher's Guide

Middle Grades - $35

Colored Filmstrips

1. Communities: The Organization of Living Things
2. Man and Biological Communities
3. Sea Shore Communities
4. Fresh Water Communities
5. Plant Communities ... How Water Affects Them
6. Wildlife Conservation
7. Changing Plant Communities
8. Insects ... How They Are Grouped
9. How Animals Are Grouped
10. Animal Clothing
11. Story of Soil
12. Kinds of Plants
13. Vegetative Reproduction

Books

Environmental Handbook by Garret DeBell
The Frail Ocean by Wesley Marx
Defoliation by George Wald
Teacher's Guide

High School - $78

Colored Filmstrips

1. The Arrangement of Leaves on Seedplants
2. Inflorescences of the Seedplants: Raceme Types
3. Inflorescences of the Seedplants: Cyme Types
4. Vegetative Ramification of the Higher Plants
5. Succulent Plants: Stem Succulence

6. Succulent Plants: Leaf Succulence
7. Tools of the Insectivores to Catch Animals
8. The Nature of Solids
9. The Nature of Liquids
10. The Nature of Gases
11. Erosion: A Force Behind Our Moving Mountains

AVID Corp.
(see above)

OPEN YOUR EYES (middle grades)

Open Your Eyes is a timely series of 10 full-color, sound, filmstrips dealing with the environment and the interrelationship of all living things. The series was designed by Mrs. Mildred House, conservationist, photographer, and author. One record is included with each set and a teacher's guide with each unit.

Unit 1: Air, Soil and Water
Unit 2: Primitive Plants
Unit 3: Invertebrate Animals Excluding Insects
Unit 4: Insects
Unit 5: Fishes, Amphibians, and Reptiles
Unit 6: Birds and Mammals
Unit 7: Wildflowers
Unit 8: Trees and Shrubs
Unit 9: Ecology of Waters and Wetlands
Unit 10: Ecology of Fields and Forests

Each set of two filmstrips is $23 and the complete series of 10 is $115.

AVID Corp.
(see above)

MAN AND HIS ENVIRONMENT: IN HARMONY AND IN CONFLICT (grades 10 and up)

An excellent treatment of man's dependence upon nature using art, architecture and photography, and a combination of narrative, poetry and music. The strip discusses the urban environment and man's need to examine his attitudinal values toward his cities. Teacher's guide included. Two Kodak Carousel cartridges with two discs or cassettes $89.95.

MAN AND HIS ENVIRONMENT: IN HARMONY AND IN CONFLICT (grades 6 to 9)

One cartridge with disc or cassette; $59.75

Center for Humanities
2 Holland Avenue
White Plains, NY 10603

THE RIGHT TO EXIST (grades 4 to 12)

An examination of the quality of our environment and the needs for good land and water management practices. The story of rare and endangered species and the reasons for their decline are emphasized. A teacher's guide, response cards, and spirit master answer sheet are included. One cassette and one strip, #NSF/C-1, $11.50.

Colonial Films, Inc.
752 Spring Street
Atlanta, GA 30308

ECOLOGICAL COMMUNITIES (grades 7 to 12)

The recurring themes of succession, climax vegetation, and the recycling of elements in six ecological communities are used to introduce concepts such as plant and animal interdependence, organismic adaptation, and the physical factors found in each community. Colorful, intriguing, and well done. The series includes 6 filmstrips with 3 discs (#S205, $55), or 6 cassettes (#M205, $70) and a teacher's manual.

The Deciduous Forest
Ponds and Lakes
The Stream
The Meadow
The Thicket
The Northern Coniferous Forest

Coronet
65 E. South Water Street
Chicago, IL 60601

POLLUTION (grades 6 to 12)

The series provides for a wide coverage of pollution problems and suggests ways to deal with them. Fine up-to-date photographs and good narration help make this an exceptional series. The kit includes six filmstrips with discs or cassettes. Titles are: What Is It?; Our Air; Our Waters; Solid Wastes; Pesticides and Radioactive Wastes; and What We Can Do. #S198, with disc: $53 series; #M198 with cassette: $70 series.

Coronet
(see above)

TREEMAN: A FIRST ADVENTURE IN ECOLOGY (grades K to 5)

A combination of natural photography and animated characters is used to tell the story of pollution and carelessness. Suggestions are given for involving children in recognizing and preventing misuse of the environment. 18 study prints, a teacher's guide, and one strip with disc: $36; with cassette: $37.50.

Coronet
(see above)

NO, NO! ... GO, GO! (grades K to 3)

The strip focuses upon 14 situations which illustrate environmental and social action aspects of life in our country. One strip with one cassette, posters and a teacher's guide. #F423 $11.50

Creative Visuals
Box 1911
Big Spring, TX 79720

OUR POLLUTED WORLD: THE PRICE OF PROGRESS (grades 7 and up)

A study of pollution as it relates to economic growth using the United States, Italy, and India as cases. Well-done diagrams, discussion guide with background information and a list of suggested activities are included. One film strip with disc, $15; with cassette, $17.50.

Current Affairs Films
527 Madison Avenue
New York, NY 10022

INVESTIGATIONS IN ECOLOGY: A BIOLOGICAL APPROACH (grades 9 to 12)

The program is comprehensive enough to provide the foundation for an entire unit on ecology from an investigative, biological point of view. The color-slides are hand drawn, daylight projectible and accompanied by a teacher's manual which includes the following features: a brief statement of the purpose of each unit, a summary of contents of each unit, a sampling of evaluation suggestions, and a list of correlated textbooks and other references. The units include the following:

A	#68959	Problems in Ecology	$25
B	#68960	Ecological Populations and Communities	"
C	#68961	Nutritional Relationships in Nature	"
D	#68962	Material Cycles in Nature	"
E	#68963	Food Webs and Pyramids	"
F	#68964	Ecological Succession	"

The complete series of six Kodak Carousel Cartridges with 60 slides each is available for $119.50.

Denoyer-Geppert Audio-Visuals
Times Mirror
5235 Ravenswood Avenue
Chicago, IL 60640

CLEARWATER: A DREAM FOR A RIVER AS TOLD BY PETE SEEGER (grades 7 and up)

The story describes the changing quality of the Hudson River as it flows from the Adirondacks to New York City and of Pete Seeger's attempts to save the river from its fated pollution. Lively, entertaining learning experience with a message: "We know this world won't be saved from the human race unless we can get people together." Teacher's guide. One color-sound filmstrip with disc (#69705) $34

Denoyer-Geppert
(see above)

ECOLOGY: THE SCIENCE OF GOOD EARTHKEEPING (grades 4 to 9)

The series emphasizes the need to understand ecological interrelationships to solve the problems of today's environment. The series includes: Earth: A Planet Worth Saving; Our Polluted Planet. #72461, with disc: $25.50 for the series, $13.50 each. #72462, with cassette: $29.50 for the series, $15.50 each.

Doubleday & Co., Inc.
501 Franklin Avenue
Garden City, NY 11531

WEB OF LIVING THINGS (grades 5 to 9)

This series stresses the basic ecological relationships which are needed to understand current environmental problems. Food chains, energy flow, communities; the nitrogen, carbon dioxide, and oxygen cycles are among the concepts explained in the five strips.

Discovering the Many Kinds of Plants and Animals
Discovering the Many Ways of Plants and Animals
Investigating the Conditions of Life
Observing Communities of Living Things
Observing Natures Network

#72401, with disc: $63 series, 13.50 each
#72402, with cassette: $73 series, 15.50 each

Doubleday
(see above)

AN ATMOSPHERE IN CRISIS

Module presenting characteristics of atmosphere, air and how affected by pollutants. Activities include making pollutants, treating them, and determining effects upon materials (supplies included). Overhead transparencies and set of 35 mm slides in module also. $34

Educational Modules, Inc.
266 Lyell Avenue
Rochester, NY 14608

NOISE POLLUTION

Unit examines the biological and social effects of noise pollution on the individual and the community. A set of 35 mm slides used for illustration and a cassette allows students to experience simulated hearing losses. $24

Educational Modules
(see above)

DEATH OF A RIVER

This module traces history of a polluted water source through a sequence of natural and man-made phenomena. Includes set of 35mm slides, overhead transparency masters and four laboratory experimental activities. $29

Educational Modules
(see above)

EVERYONE'S TALKING POLLUTION

A comprehensive and technical treatment of chemical, biological, ecological and economic aspects of air and water pollution. Lectures, set of 47 slides 35mm, 18 transparency masters and experimental classroom activities. $140

Educational Modules
(see above)

OUR ENVIRONMENT 1: FRESH WATER COMMUNITIES (grades 4 to 6)

A set of 10 transparencies, two wall charts, spirit masters, guide and four sound film strips (Streams, Rivers, Ponds, Lakes). A study of water in supporting living systems, their interaction and disruption. Records or cassettes available. Complete set EEP-1000, $66.

EMC Corp.
180 East Sixth Street
St. Paul, MN 55101

OUR ENVIRONMENT 2: SOUND AND NOISE (grades 4 to 6)

Two sound filmstrips, guide, wall chart to make students aware of the noise problems and suggested solutions. With records or cassettes EEP-1002, $30.

EMC
(see above)

OUR ENVIRONMENT 3: AESTHETICS (grades 4 to 6)

Two sound filmstrips, guide, wall charts and activities sheets dealing with man's need for beauty and order and relates to urban life. With records or cassettes EEP-1003, $32.

EMC
(see above)

OUR ENVIRONMENT 4: ATMOSPHERE (grades 4 to 6)

This package consists of four sound filmstrips, guide, four wall charts, and activities spirit masters. Filmstrips are "Earth is a Spaceship Too," "What is Air?", "What is Weather?", "Our Spaceship Earth-Can it Survive?" Explains the atmosphere and the natural cycles man is upsetting through pollution. Record or cassette, EEP-1004, $69.

EMC
(see above)

OUR ENVIRONMENT 5: SALT WATER COMMUNITIES

Set of sound filmstrips, guide, student workbook, wall maps. Filmstrips are "The Living Ocean", "Tidepools", "Oceans Alive?" A study of the ocean -- the largest area of the earth. Complete set with record or cassette, EEP-1005, $61.50.

EMC
(see above)

THE EYE AND LIGHT

The module investigates the physiological effects of light pollution. The anatomy of the eye is illustrated and the nature of light and the effects of infrared and ultraviolet radiations described. The module includes a teacher's manual, 18 35mm slides, plastic mounted cross-section of the eye and suggested student projects. #4070, $28

Educational Modules, Inc.
266 Lyell Avenue
Rochester, NY 14608

HEALTH AND ECONOMIC CONSEQUENCES OF ENVIRONMENTAL POLLUTION

An expanded version of the smaller kits "Death of a River" and "An Atmosphere in Crisis." This is a comprehensive and technical treatment of the problems, utilizing a teacher's manual with lecture material, chemicals and apparatus for 10 classroom activities, 47 35mm slides and 28 transparency masters. #4059, $140

Educational Modules, Inc.
(see above)

SOLID WASTE AND RECYCLING

The processes of and potential for recycling of solid wastes is examined. Causes of solid waste problems are studied under such topics as population growth, urbanization, planned obsolescence and disposability. The topics are coordinated with visual aids and five classroom activities. The set includes teacher's manual, 10 overhead transparency masters, 20 35mm slides and experimental and chemical apparatus. #4071, $58

Educational Modules, Inc.
(see above)

OUR MAN-MADE ENVIRONMENT (intermediate grades)

This program is aimed at making students more aware of their experiences in the man-made environment, instilling confidence in their ability to judge and decide (and these are responsibilities and opportunities) and broadening their aspirations for the future environment. Activities and text revolve around four parts: What is the Man-made Environment? Why Do We Build It?, What Determines Its Form? and How Do We Change It? Student books (OMME-7) $4.95 each (quantity discounts available); teacher's guide, $2 each.

Group for Environmental Education, Inc.
1214 Arch Street
Philadelphia, PA 19107

THIS UNIQUE BIT OF LIFE: TREES AND OUR ENVIRONMENT (grades 4 to 12)

The filmstrip depicts the essential, life sustaining role trees and forests play in our environment, and includes beautiful photographs of some of America's finest woodlands. One strip with one disc or cassette and teacher's guide. disc, $18; cassette, $20

Guidance (with American Forest Institute)
41 Washington Avenue
Pleasantville, NY 10570

MAN'S NATURAL ENVIRONMENT: CRISIS THROUGH ABUSE (middle grades)

Two strips with two discs: $35; with cassettes, $39

Guidance
(see above)

EXPLORING WATER PACKET

This kit contains 32 "Pond Life" flash cards, 11 slides, the book Pond Life, and an 8-minute, 50-second tape -- Exploring a Pond. $10.95

Gull Lake Environmental Education Project
12685 East C. Avenue
Augusta, MI 49012

SURVIVAL KIT: ECOLOGY AND SOCIAL ACTION (grades 7 to 12)

The kit is designed to develop awareness of the need for environmental reform. Three strips with two discs,12 readers, one Field Guide, and a teacher's manual. $50

Harper & Row Pubs.
School Dept.
2500 Crawford Avenue
Evanston, IL 60201

POLLUTION (grades 4 to 6)

A general introduction to the problems and possible solutions of pollution -- air, water, land, and noise -- using a statistical approach. The series includes: The Polluters; Air; Water; Land; Noise; and The Problem is Now. Six filmstrips with three discs (#89-4154/6), $54 for the series, $11 each; with cassette (#89-4154/8), $59 for series, $12 each.

Holt Rinehart & Winston
383 Madison Avenue
New York, NY 10017

URBAN STUDIES SYSTEM (grades 4 to 12)

A flexible, interdisciplinary, activities-centered program for students to deal with the diverse elements and complex problems of urbanization. Contains a 3-D metropolitan model, overlay set, development set, set of 35mm slides (20), pollution simulation kit, overhead transparencies, role-playing cards, pictures and manual. Set for 30 students No. USS-5630, $235.

Hubbard Scientific Company
2855 Shermer Road
Northbrook, IL 60062

THE GODS WERE TALL AND GREEN (grades 4 and up)

A two-part photographic essay, beautifully done, revealing the life cycle of the forest (Kingdom of the Forest), and exploring the evolution of trees, birds, insects, and early man, (An Ancient Kinship). The filmstrips could easily be used in science, poetry, art and humanity classes. Two strips with two discs (#LY35272SR), $33; with 2 cassettes (#LY3527SC) $36.

Lyceum Productions
Box 1226
Laguna Beach, CA 92652

THOREAU ON THE RIVER: PERSPECTIVES ON CHANGE (grades 7 to 12)

This strip could readily be used in literature, social studies, and environmental studies courses. It effectively contrasts the Concord River of today with a view as described by

Thoreau in his "A Week on the Concord and Merrimack Rivers." One filmstrip with one disc: $24; cassette: $25.

McG-H Films
1221 Avenue of the Americas
New York, NY 10020

WHAT IS ECOLOGY?

A good introduction of ecological principles from a biological point of view integrating concepts social and psychological in scope to result in an implied view of human ecology. Grades 5 to 12, sound-color filmstrip with manual. $9.95

Multi-Media Productions, Inc.
P.O. Box 5097
Stanford, CA 94305

WHAT IS POLLUTION?

An effort to make the origin of pollution understood. Looks too at values as e.g., pollution results from a failure to see the true costs of every element in our material life. Color-sound F.S. $9.95.

Multi-Media
(see above)

WHAT IS AIR POLLUTION?

Lends an understanding to the elements that cause air pollution. Color-sound filmstrips. $9.95

Multi-Media
(see above)

PROSPERITY EQUALS POLLUTION

Presents relationships between economics and pollution. Color-sound F.S. $9.95

Multi-Media
(see above)

THE AUTOMOBILE BEYOND AIR POLLUTION

Inquiry about unlimited use of private vehicles and the support they require. Interdisciplinary, problem-solving approach. Color-sound F.S. $9.95

Multi-Media
(see above)

JOHN JAMES AUDUBON: ARTIST, SCIENTIST, PIONEER (grades 4 to 9)

As the title suggests, the material is adaptable to art, science, and history classes. Audubon is shown through his brilliant drawings. Four filmstrips with records, $50; with cassettes, $54.

MPB

ENVIRONMENTAL CRISIS: WHAT THE INDIVIDUAL CAN DO

Color sound filmstrip set with guide and bibliography. Useful from upper elementary through high school, this program gives specific suggestions on what changes can be made both on personal and community levels. No. 388-11902. $15

National Education Association
Publication-Sales Section
1201 Sixteenth Street N.W.
Washington, D.C. 20036

EC TEACHERS' KIT

Contains a 52-frame color-sound filmstrip on environmental quality (EC), 25 copies of the 1973 National EQ Index, an EQ Reference Guide and a booklet on appraising community EQ. $10

Educational Servicing Section
National Wildlife Federation
1412 Sixteenth Street, N.W.
Washington, DC 20036

THE LAST FRONTIER: OCEANS (grades 7 to 12)

The history of the ocean's importance to man, its potential use as a resource, and the consequences of misuse are examined. An excellent overview of problems associated with abuse of resources is provided. A teacher's manual and spirit master worksheet are included. The lesson plan includes very good ideas for integrating the material into either science or social studies classes. One strip and one disc. $9

N. Y. Times
229 W. 43rd Street
New York, NY 10036

DIVERSITY (grades 5 to 9)

Part one in the Olin "Keys to Basic Ecology" series. An outstanding introduction to ecology. The first series includes six strips with three discs. $54

Land
Land Changes
Water
Plant Life
Animal Life
Organisms Change (Succession)

Olin Educational Services
460 Park Avenue
New York, NY 10570

INTERRELATIONSHIP (grades 5 to 9)

This second set of the three-part series, "Keys to Basic Ecology," has the same fine qualities of the Diversity set. The filmstrips build on the concepts developed in the first set and the material is more complex. This set is especially valuable for its explanations of why and how man has altered nature and its positive attitude for resolving the "conflicting needs of pollution control and political jurisdiction."

Olin Educational Services
(see above)

ECOLOGY (grades 7 to 12)

An activity oriented program dealing with 10 major concepts, including competition, food chains and pyramids, adaptation, nutrient cycles, succession, niche, living and nonliving factors in the environment, and finally the "balance of nature." The kit includes 32 color transparencies, a comprehensive teacher's manual which outlines behavioral objectives, and suggests procedures, and includes background information and suggested classroom activities. #78050, $120.

Science Kit Inc.
777 East Park Drive
Tonawanda, NY 14150

POLLUTION SCIENCE (grades 7 to 12)

The program is built on 16 full-color transparencies with overlays and organized into a study of major air pollution problems and their effects upon human health, followed by an examination of water pollution problems. A comprehensive teacher's manual includes expected student outcome, suggested procedures for presenting the lesson, background information and suggested classroom activities. #78055, $75.

Science Kit, Inc.
(see above)

DESERT LIFE (grades 2 to 5)

The filmstrips explore deserts around the world, emphasizing the desert as a unique landform with unique interrelationships between plants, animals, weather, etc. Teacher's guide and four silent filmstrips, #JH 3450F, $26 for the series, $7 each. The titles include:

What Is a Desert?
How Plants Survive
Balance of Life in the Desert

Scott Educational Division
104 Lower Westfield Road
Holyoke, MA 01040

ECOLOGY INTERACTIONS AND ENVIRONMENTS (grades 9 to 12)

A set of seven color filmstrips with records or cassettes which give a close look at our everchanging biosphere. The titles include:

There is No Place Like Home
Guess What's for Dinner
Give and Take
The Right Neighborhood
It's a Matter of Life and Death
Change is the Name of the Game
Man -- Hero or Villain

Series: $88, with records; $95, with cassette.
Individual titles: $13 with record; $14 with cassette.

Scott Educational Division
(see above)

WATER POLLUTION (grades 7 to 12)

Part of Great Issues of This Technological Age series contains two sound filmstrips, 10 transparencies with 21 overlays and teaching guide. Transparencies take science, economic, political science and social science approaches to control, use, conservation, treatment, and cycling of water. Filmstrip presentation is in two parts: Ecology and Waste Water Treatment. Complete set with record $45 (No. 70015-100) with cassette $46 (No. 70015-200).

Scott Educational Division
(see above)

AIR POLLUTION (grades 7 to 12)

A companion to "Water Pollution" with 2 sound filmstrips, 9 transparencies with 23 overlays and teaching guide. Overlays oriented to political, economic, sociological and science aspects. Filmstrips: Part I - ecological, biological, pathological in nature, Part II on photochemical smog and particulates. Complete set with record $45 (No. 70016-100), with cassette $46 (No. 70016-200).

Scott Educational Division
(see above)

NO TIME TO WASTE	See Simulation Section
RECYCLING RESOURCES	See Simulation Section
NATURAL RESOURCES CONCEPT PACK	See Simulation Section
WATER POLLUTION	See Kits and Labs Section

ENVIRONMENTAL/AWARENESS UNITS

This is one of a two-part Earth Corps program and is available for two grade levels. They are excellent units, which focus on developing pupils' awareness of their environment. The program is activities oriented, flexible and interdisciplinary. Each unit includes 12 transparencies, posters, 20 photographs, a record, song sheets, 24 illustrated student activity books and a very useful and easy to follow teacher's guide.

1. LOOK AROUND YOU (grades 1 to 3)
   Helps the child to develop critical awareness of his surroundings. No. 4307, $24 (extra activity books No. 4310 @ 75¢)
2. FIRST FOLLOW NATURE (grades 4 to 6)
   Involves children in exploring more deeply why some environments are more pleasant than others. They discover that man's acts are environmentally sound when they follow the functionally balanced designs of nature. No. 4308, $24 (extra activity books No. 4311 @ 75¢)

Scholastic Book Services, Inc.
904 Sylvan Avenue
Englewood Cliffs, NJ 07632

ECOLOGY/CONSERVATION UNITS

Introduces students to science of ecology, especially how all living things are interrelated, the intricate balance of nature and how man can upset it. An excellent entree for integrating a child's understanding of different environments and problems. Each unit includes 24 activity books, nine life zone transparencies, cycles wall chart and teaching manual.

Scholastic Book Services, Inc.
(see above)

EARTH IS OUR HOME (grades 3 and 4)

Provides basic scientific information -- how soil is made, how rain is made, food chains, communities, etc. No. 4302, $24 (extra activity books No. 4305 @ 75¢)

Scholastic Book Services, Inc.
(see above)

SHARING THE EARTH (grades 5 and 6)

Presents natural cycles, life zones and interdependence of animals and plants. No. 4303, $24 (extra activity books No. 4306 @ 75¢)

Scholastic Book Services, Inc.
(see above)

EARTH ISLAND (grades 4 to 8)

An introduction to ecology in action dealing with the interrelatedness in the environment, man's control over it, and helpful and harmful actions of man. Kit includes 3 filmstrips, student handbooks, guide, posters and data cards. $77

Simon and Schuster
1 West 39th Street
New York, NY 10018

AMERICAN URBAN CRISIS, GROUP I

This series of filmstrips with accompanying cassettes presents an overview of topical problems. The root causes are examined and possible solutions suggested. Set: $57.50.

The Roots of Our Urban Problems
The Air Pollution Menace
Water Pollution -- A Complete Problem
Solid Waste -- A New Pollutant
The Transportation Crisis
The Housing Crisis

Society for Visual Education, Inc.
1345 Diversy Parkway
Chicago, IL 60614

ECOLOGY (grades K to 3)

A review of urban, suburban and rural environmental problems. The formation of a classroom action club to solve problems and present solutions is suggested. The kit includes five strips, five cassettes, 30 coloring books, student activity sheets and a teacher's guide. #SAC 2019, $89.95.

Spoken Arts
310 North Avenue
New Rochelle, NY 10810

ECOLOGY

The title is a misnomer; this sound filmstrip is less about ecology than environmental problems. Although sometimes bleak in its assessment, it is not terrifying. Examines pollution and its effects -- social, economic and pathological. Resources are reviewed from a human use standpoint, and brief statistics on waste and pollutant generation are effectively used. This is a good problem overview with a most clever ending. $19.95

Twenty-Third Publications
48 Main Street
Noank, CT 06340

ECOLOGY AND AGRICULTURE (grades 9 to 12 and up)

The International Film and TV Festival of New York judged this multi-media kit the best filmstrip series on ecology produced in 1971. The series is well-organized, timely and informative. The kit includes five sound filmstrips with cassettes, reel tapes, or records, illustrated scripts for each filmstrip, overhead transparencies, reference guide, additional resource materials and a bonus cassette report. The filmstrips include: Ecology and the Agricultural Environment; Soil and the Agricultural Environment; Water and the Agricultural Environment; Air and the Agricultural Environment; People and the Agricultural Environment. $40.50

Vocational Education Productions
California State Polytechnic College
San Luis Obispo, CA 93401

WHAT IS ECOLOGY?

An excellent introduction to ecology, defining terms and exemplifying basic principles. Describes interrelationships, populations, communities, ecosystems, food chains, food webs, simplified laws of thermodynamics and biogeochemical pathways. Principles of ecology defined in this production are synthesized and summarized in a sequence on the cross-Florida canal. One of the best introductory programs available (applicable for grades 5 to 12). With record $23; with cassette $26.

Warren Schloat Productions, Inc.
Pleasantville, NY 10570

AIR POLLUTION

Two sound color filmstrips. Part one is elementary in scope and applicable for grades 4 and up. Defines air pollution and reveals sources, effects and means of monitoring. Part II is more technical (jr. high-high school) and looks at classification of pollutants, treatment and assessment. With record $40, cassette $46.

Warren Schloat Productions, Inc.
(see above)

WATER POLLUTION

Comprehensive, well-done color sound filmstrips (two) with mixture of excellent pictures and graphic information. Examines sources and effects of water pollution of various kinds and discusses food pyramids and productivity. With record, $40, cassette $46.

Warren Schloat Productions, Inc.
(see above)

SOIL

Very good two-part sound filmstrip on the formation, cycling and uses of soil with notes on succession, diversity, biotic balance. With record $40; cassette $46.

Warren Schloat Productions, Inc.
(see above)

MAN AND THE CITY (grades 9 and up)

A study of the relationship between man and city, contrasting the aesthetic impact of the city with the effect of nature. An illustration of the consequences of overpopulation using wildlife and laboratory animals is used to depict one of the ways in which the city is at odds with man's biological and psychological needs. The series includes: Man's Needs; Man's Surroundings; two discs or two cassettes; two Kodak Carousel cartridges with 150 slides each. $95

Warren Schloat Production, Inc.
(see above)

MAN CHANGES HIS WORLD, PARTS I & II (grades 6 and up)

The history of man's struggle with his environment, from Stone Age man to modern man and his marvels of technology. The strip suggests ways in which the continuity of man's development can allow him to overcome today's problems. Two strips with two discs, $40; two cassettes, $46. Teacher's guide included.

Warren Schloat Production, Inc.
(see above)

Educational materials available

SILENT FILMSTRIPS AND FILMLOOPS

ECOLOGY (grades K to adult)

The set presents a visual context for understanding the systems and interrelationships which are the subject matter of ecology and environmental study. Titles include:

The Biosphere
Ecology and Ecosystems
The Physical Environment
Ecosystem Processes
Biomes
Man and the Biosphere
Man and Living Things
Man, Technology and Pollution
Population

Set of 9 filmloops: $195, $22.95 each.

Hester and Associates
11422 Harry Hines, #212
Dallas, TX 75229

MAN AND HIS ENVIRONMENT (grades K to adult)

This series describes cities by the way man functions within them, and tells how man has constructed his "new" environment. Titles include:

The Inner City I
The Inner City II
Suburbia
A Portrait of a Small Town
Faces in the City
City at Work
City at Play
Moving City
Where I Live
Signs of the City
Times of the City
The Fair

Set of 12 super 8mm filmloops: $243, $22.50 each.

Hester and Associates
(see above)

OUR NATURAL ENVIRONMENT (grades K to adult) super 8mm loop

A very adaptable series dealing with single topics within the environment. The titles include:

The Desert
The Mountains
Lakes and Rivers
Water
The Sky
Rain

Set: $128.25; individual titles $22.50

Hester and Associates
(see above)

FRESH WATER ENVIRONMENTS (series) (grades 4 to 12)

The series, developed for the science classroom, emphasizes recognition of freshwater vertebrates, including some not previously depicted by the media. Unique underwater photography and overall useful series which includes:

The Pond Environment I -- (Plankton)
The Pond Environment II -- (Organisms Inhabiting Aquatic Vegetation)
The Pond Environment III -- (Organisms Using Surface Films)
The Stream Environment I-III -- (Aquatic Insects)
Identification of Freshwater Organisms -- (Test film)

THE WOODS AND THINGS (grades 1 to 6)

A beautifully done film which could be enjoyed by all ages and would be especially useful for prefield trip activities. The camera captures the woods and its inhabitants with revealing close-ups of many life forms. Color-silent 16mm.

Churchill Films
622 N. Robertson Blvd.
Los Angeles, CA 90069

THE EARTHS RESOURCES (grades 4 to 8)

A thorough survey of the major resources of the biosphere. In each case attention is given to formation, economic value, and environmental problems associated with their use. The series includes:

- Atmospheric Resources
- Fuel Resources
- Soil Resources
- Rock Resources
- Ocean Resources

6 strips with teacher's guide (#619020), $41; $7.50 each.

McGraw-Hill Films
1221 Avenue of the Americas
New York, NY 10020

CLASSROOM NATURE ACTIVITIES (grades 1 to 5)

A "how to" series designed to help bring the world of nature into the classroom. The titles include:

- How to Make a Salt Water Aquarium
- How to Make a Terrarium
- How to Keep Mammals in the Classroom
- How to Keep Reptiles in the Classroom
- How to Keep Plants in the Classroom

Set of 6: $42; each title: $7

Troll Associates
320 Route #17
Mahwah, NY 07430

ECOLOGY OF THE URBAN ENVIRONMENT (grades 3 to 8)

The problems affecting contemporary living are investigated, including:

- Sanitation
- Water Supply
- Air Pollution
- Population
- Urban Wildlife
- Housing Patterns

7 strips, captioned and teacher's guide (#406), $37.50 series; $7 each.

Urban Media Materials
212 Mineola Avenue
Roslyn Heights, NY 11577

ENVIRONMENTAL EDUCATION BIBLIOGRAPHY

For Pre-School through Grade 3

Environmental education is concerned with the nature of man, the nature of the biosphere in which we live and the interrelationships that exist between man and biosphere.

In a day and age when the results of the human arrogance, which sets man outside of the beautifully interrelated systems of nature, are violently apparent in the form of pollution, overpopulation, with its many resultant strifes, environmental degradation and over-exploitation of limited resources, it is imperative that people become educated to the point of a basic environmental literacy. It is a task for the total educational continuum. Teachers and interpreters at every level will have to do their part.

In the pre-school and primary grades it is important that children be given as wide an exposure as possible to environmental experiences. They can be developing an "experience bank" upon which they can continue to draw for concept formation as they develop. These years are also important ones in attitude development and emphasis should be placed on this, remembering strongly the exemplary role of the teacher in attitude formation.

This series of AIDS was compiled for the U. S. Office of Education by the library staff of the Hatheway School of Conservation Education, the education division of the Massachusetts Audubon Society. They represent a select, rather than comprehensive, listing of materials prepared for the information and convenience of teachers. Selection of material for these lists does not constitute official endorsement or approval of it by either Massachusetts Audubon Society or the U. S. Office of Education, to the exclusion of others which may be suitable.

ENVIRONMENTAL EDUCATION PROGRAM, Dean Bennett, Coordinator, Yarmouth, ME

A theme environment has been chosen for each grade level. "Within the theme environment, students will be encouraged to interact with the environment or utilize resources in interesting ways and, in so doing, they will become aware of, or guided in, the identification of past, present, or pending physical environmental problems."

Grades K-1 Theme: The School. Grades 2-3 Theme: Neighborhood. Grades 4-5 Theme: The Community. Grade 6 Theme: The Region. Teachers' guides are available for each grade. These are in two parts. The first treats individual units, the second gives background information for the teacher.

IF YOU LIVE IN THE CITY, WHERE DO YOU LIVE?

See description under Films.

OPERATION NEW YORK: USING THE NATURAL ENVIRONMENT OF THE CITY AS A CURRICULUM RESOURCE, Board of Education, City of New York, 1960

Valuable suggestions for teachers in any urban area. "The interrelationships of living things, including man, with their physical surroundings are understood as boys and girls explore the many 'little environments' which are found within the city."

PEOPLE AND THEIR ENVIRONMENT: TEACHERS CURRICULUM GUIDES TO CONSERVATION EDUCATION, Matthew J. Brennan, J. C. Ferguson Publishing Co.

A K-12 curriculum developed from the Conservation Curriculum Improvement Project of Department of Education, State of South Carolina. Elementary school teachers will be particularly interested in the three volumes covering grades 1 through 6 and the "Outdoor Laboratory" volume for grades 1-12.

SCIENCE AND HISTORY, Nuffield Junior Science, SRA Canada, 1967

This illustrated Teacher's Background Booklet suggests many ways in which history, considered in terms of man's development and his increasing understanding and control of his environment, can be made more significant and exciting for elementary school children.

The author suggests "Ideas to Explore" such as the "Scientist in Early Man," in which children explore the basic problems of early man in finding food and shelter. Another exploration, "Cave Artists," leads children to try painting with natural materials and potting with native clays.

SCIENCE CURRICULUM IMPROVEMENT STUDY (SCIS), Robert Karplus, director, Lawrence Hall of Science, University of California, Berkeley

This is an ungraded, sequential physical and life science program for the elementary school. The teaching strategy is for children to explore selected science materials. They are encouraged to investigate, to discuss what they observe, and to ask questions. The SCIS teacher has two functions: to be an observer and to be a guide. Materials are of four types: (1) Teacher's Guide, (2) Pupil Manuals, (3) Laboratory Materials, (4) Films. Titles of some of the units now available in commercial editions from Rand McNally: Material Objects, Life Cycles, Organisms, Interaction and Systems, Populations.

THE SOCIAL SCIENCES: CONCEPTS AND VALUES, Harcourt, 1970

This K-6 series is one of the best of the very few social studies texts emphasizing basic ecological concepts. "Concepts and values -- the concepts of man as a social being, and the values that make him human -- are the substance of this program."

FILMS

BEAVER DAM, Primary 4-6, color, 15 min., McGraw-Hill Cont. Films

The beaver is shown in its natural habitat as he constructs a dam, floods farmer's field, and is saved by two boys from farmer's wrath. Excellent photography, unusual closeups and a catchy theme song combine to make this film a happy learning experience.

IF YOU LIVE IN THE CITY, WHERE DO YOU LIVE? National Instructional Television Center, Box A, Bloomington, IN 47401

Five 30-minute color television programs, teacher's guide, and 25 activity cards for student use. Series developed by WGBH Educational Foundation in Boston. The materials stress the child's place in the urban ecology. Also available on 16mm film.

TIME OF WONDER, Robert McCloskey, color, 13 min., Weston Woods

Summer is the Time of Wonder and Penobscot Bay, the place, beautifully illustrated in sun, rain, wind and fog. This is one of an excellent series of movies using an iconographic technique -- motion pictures from still material where the only actual motion is that of the camera. Lens can select details and release motion artist has drawn into pictures. Children seem to feel book has come to life. Musical background tailor-made for each film by Arthur Kleiner, music curator of Museum of Modern Art. Time of Wonder could be used with an elementary class just to set a mood, before a field trip perhaps, or to introduce a unit on weather or seasonal changes.

WHAT CAN YOU FIND? color, 11 min., Thorne Films

This film presents a series of visual and tactile outdoor "experiences." Three children are shown finding leaves, rocks, insects and animals as they walk through fields, woods, backyards, and near water. Scenes of fall, winter, spring, and summer show patterns of season change. The narration is poor, but film can easily be used without sound.

FILMSTRIPS.

CONSERVATION IN THE CITY, 52 frames, silent, color, $6.00 ea., $18 per set, Encyclopaedia Britannica

Part I - Underfoot; Part II - Eye Level; Part III - Overhead

A new and interesting approach to looking at the city environment. Each film presents a number of different areas for study and discussion; nature study, ecology, conservation and problems (pollution) are some of these. Color is very good as are the questions and suggestions for activities. Some of the vocabulary may need explaining. (Curr. Area: general science, social studies, nature study)

DISCOVERING LIFE AROUND US, 33 frames, silent, color, $6 ea., $30 per set, Encyclopaedia Britannica

Shows relationship between living things and introduces some ecological concepts. Size relationships in film are not true and some vocabulary will need explaining. Can be used to introduce discussion of familiar areas or as a prelude to a field trip. (Curr. Area: science, social studies) Series titles: A Visit to the Farm, A Visit to the Garden, A Visit to the Pond, A Visit to the Seashore, A Visit to the Woods.

THE FARMER'S ANIMAL FRIENDS, 23 frames, silent, color, $5.75 ea., $3.50 per set, Jam Handy

Series' Titles: Cows on the Farm, Horses on the Farm, Pigs on the Farm, Sheep on the Farm, Chickens on the Farm, Cats on the Farm. Farm animals, how and where they live - what they eat and how they care for their young. Useful either prior to or after farm field trip. (Curr. Area: science, social studies)

HOW WE GET OUR FOODS, S. V. E., 41 frames, silent, color, $5.50 ea., $20 per set

The Story of Milk, The Story of Bread, The Story of Fruits and Vegetables, The Story of Meat. Basic introduction to food sources. New words introduced. Photographs are dated. Question frames stimulate discussion. (Curr. Area: social studies)

WHERE DOES THE BUTTERFLY GO WHEN IT RAINS? Mary Garelick, color, silent, $7.25, sound $9.25, Weston Woods

The text is built on speculation and partial answers, leaving the viewer with a multitude of other questions as well as a real desire to find out just where the butterfly does go. The illustrations convey the atmosphere. This is one of the many Weston Woods filmstrips that are faithful adaptations of the finest picture books, including Caldecott Medal Winners. A picture-cued booklet containing the story is provided with each filmstrip. For the sound filmstrip a related phonograph record features an expert story-teller.

GRAPHICS

ECOLOGY WHYS, Carnegie Museum, 4400 Forbes Ave., Pittsburgh, PA 15213

Two sets, of six charts each, on heavy cardboard 20" x 24". Charts cover such subjects as Animal Homes in Trees, Soil -- How It Is Made, What Good are Trees, Succession on a Fallen Log. Accompanying teachers' manuals contain a lesson plan, follow-up activities, a glossary and a reading list.

INSTRUCTOR ECOLOGY POSTER SETS, Instructor Publications, Inc., 1970

This poster series was designed for use by teachers and pupils of elementary grades. The teacher's guide provides background information and suggested activities for each poster. Another series, similar in format, is entitled Eco-Problems.

LIFE EDUCATIONAL REPRINTS, Life Educational Reprint Program, Box 834, Radio City Post Office, NY 10019

The editors of Life have reprinted many of the pictorial essays for use in schools. The series from the World We Live In is an excellent source of pictures for ecological studies at any grade level. The two latest reprints are concerned with the environmental crisis -- #69 Air Pollution and #76 Water Pollution.

STUDY PRINTS, $8 per set, Society for Visual Education

18" x 13" photographs on heavy stock in sets of 8. On the reverse of each print is factual information, questions, and suggestions for use. The color is, in general, good with the exception of the set Common Rocks and Minerals. Size relationships, especially on the animal prints, are deceptive. The Basic Science Series covers plants, animals, cloud forms, and land forms of running water. Urban Life Series introduces the child to some of the ways the people of the city work and play. Most of the prints can be adapted to use through Grade 6.

RECORDINGS

The following recordings can be used at any grade level, as a prelude to a field trip, or as a follow-up. Children should be encouraged to make their own recordings and these records could be used to suggest possibilities.

BIRDS ON A MAY MORNING, Droll Yankees, Promfret, VT

Side A takes you on a bird walk with commentary through fields, orchard, woods and swampy place. Side B gives same walk without commentary. Identifies 36 bird songs.

THE SWAMP IN JUNE, Droll Yankees, Promfret, VT

The many sounds of the swamp are heard on this record. Birds provide the background melody, while the insects add rhythm and continuity.

COMMON BIRD SONGS, Dover

Sixty of the most common birds of the eastern United States are identified. A 32-page booklet illustrates each bird.

VOICES OF THE NIGHT, Houghton-Mifflin

The calls of 34 frogs and toads of the United States and Canada.

THE SONGS OF THE INSECTS, Houghton-Mifflin

Calls of the common crickets, grasshoppers, and cicadas of the eastern United States.

BIRD SONGS IN LITERATURE, Cornell Laboratory of Ornithology

A high-fidelity record of bird songs and the poems they have inspired from Chaucer to Eliot.

SYMPHONY OF THE BIRDS, Ficker Records, Old Greenwich, CT

A symphony in three movements has been created using the songs of the birds.

VOICE OF THE SEA, Droll Yankees, Pomfret, VT

On Side A are the sounds of the harbor and the sea, and Side B has the sounds of the surf.

GOD BLESS THE GRASS, Columbia Records

Pete Seeger's parodies on conservation are good listening -- folk guitar background.

BOOKS FOR STUDENTS

Bartlett, Margaret F., THE CLEAN BROOK, Crowell, 1960

A very elementary description of the natural pollution and purification of a stream. Text and pictures together give the child a feeling for the constantly changing nature of the brook. This is a Let's Read-And-Find-Out book, one of a useful primary series edited by Franklyn M. Branley. Simple text, large print, colorful illustrations. More in this series: A TREE IS A PLANT, DOWN COME THE LEAVES, BIG TRACKS, LITTLE TRACKS, FIND OUT BY TOUCHING, FOLLOW YOUR NOSE, LISTENING WALK, MY FIVE SENSES.

Bartlett, Margaret F., DOWN THE MOUNTAIN, Scott, 1963

An imaginary trip begins at the mountain top, goes down to where plants grow, into the forest, and then the meadow. The author explores the many ways in which soil is created from crumbling rock and organic matter. Poetic style makes this a particularly good introduction to the subject.

Blough, Glenn O., WHO LIVES IN THIS MEADOW, McGraw-Hill, 1961

An easy-to-read text combined with excellent illustrations by Jeanne Bendick makes it possible to recognize the meadow's inhabitants and to understand why they are so well suited to their environment. Glenn Blough has written several other books emphasizing environmental adaptation, all published by McGraw-Hill. AFTER THE SUN GOES DOWN: STORY OF ANIMALS AT NIGHT; SOON AFTER SEPTEMBER: STORY OF LIVING THINGS IN WINTER; THE TREE ON THE ROAD TO TURNTOWN, WHO LIVES IN THIS HOUSE: STORY OF ANIMAL FAMILIES; WHO LIVES AT THE SEASHORE: ANIMAL LIFE ALONG THE SHORE.

Busch, Phyllis, LIONS IN THE GRASS: The Story of a Dandelion, a Green Plant, World, 1968

Facts about this familiar plant are discussed in such a way as to provide an elementary understanding of all green flowering plants. Illustrated with excellent photographs. This is one title in the series DISCOVERING NATURE, edited by Phyllis Busch, and designed to motivate young children to explore the natural world on their own. Other titles include: CITY LOTS: LIVING THINGS IN VACANT SPOTS, ONCE THERE WAS A TREE: THE STORY OF A TREE, A CHANGING HOME FOR PLANTS AND ANIMALS, PUDDLES AND PONDS: LIVING THINGS IN WATERY PLACES, AT HOME IN ITS HABITAT: ANIMAL NEIGHBORHOODS.

Elkin, Benjamin, LOUDEST NOISE IN THE WORLD, Hale, 1954

A picture story of a small boy's birthday wish with a surprise ending. James Daugherty's vigorous illustrations are wonderfully "noisy." Could well be used before going on a "listening walk" or when introducing noise pollution to slightly older children.

Emberley, Ed., THE WING ON A FLEA, Little, Brown, 1961

A book about shapes that helps children see triangles, circles, squares, and rectangles in an infinite number of objects in nature.

Feilen, John, AIR, Follett, 1965

An explanation of what air is composed of, with simple experiments showing that air takes up space, has weight and pressure, and that it works for man in many ways. Easy reading for 2nd and 3rd graders.

Gates, Richard, TRUE BOOK OF CONSERVATION, Children's Press, 1959

Explains in simple terms, meaning of "balance of nature" and need for man to restore forests, save the land and protect wildlife. This is one title in an excellent series for primary grades edited by Illa Podendorf, that includes simple experiments. Some others: TRUE BOOK OF ANIMAL HOMES, TRUE BOOK OF DESERTS, TRUE BOOK OF ENERGY. Accurate information through an easy vocabulary set in manuscript type.

George, Jean, HOLE IN THE TREE, Dutton, 1957

Scientifically accurate although in story form, describing how "the hole in the tree" was first started, what helped to make it bigger and bigger, and who used it as a home or a hiding place. Could easily be adapted for a flannel board story.

Goetz, Delia, RIVERS, Morrow, 1969

Using the Potomac as an example, the author describes its various types of life -- shows how pollution develops. Good starting point for second or third grade study of pollution.

Guilcher, J. M., TREE IS BORN, Sterling, 1960

Describes the life cycle of four trees; horse chestnut, oak, walnut, and pine. Excellent close-up photographs of tree structure. The text is difficult in places, but children find the photographs fascinating. This is one title in the STERLING NATURE SERIES. A FRUIT IS BORN is another, also written by J. M. Guilcher.

Hagaman, Adaline P., WHAT IS WATER? Benefic, 1960

A colorful, easy-to-read introduction to the properties of water, water's role in weather and erosion, its uses and conservation.

Huntington, Harriet, LET'S GO OUTDOORS, Doubleday, 1939

Simple text and large photographs offer an excellent introduction to the natural world of those animals readily found by small children. Useful before a field trip.

Keats, Ezra Jack, THE SNOWY DAY, Viking, 1962

A small boy's ecstatic enjoyment of snow in the city. This is only one of many picture books that can be used to reinforce and extend the small child's natural curiosity and delight in his environment. The following list is intended only as a beginning. You will find many more.

Brown, Margaret Wise, WAIT TILL THE MOON IS FULL, Harper, 1948
Burton, Helen, THE LITTLE HOUSE, Houghton Mifflin, 1952
Carrick, Carol, SWAMP SPRING, Macmillan, 1969
Ets, Marie Hall, PLAY WITH ME, Viking Press, 1955
Freschet, Bernice, THE OLD BULLFROG, Scribners, 1968
Garelick, May, WHERE DOES THE BUTTERFLY GO WHEN IT RAINS, Scott, 1961
Grossbart, Francine, A BIG CITY, Harper, 1966
Krauss, Ruth, HAPPY DAY, Harper, Row, 1949
McCloskey, Robert, MAKE WAY FOR DUCKLINGS, Viking, 1941
McCloskey, Robert, TIME OF WONDER, Viking, 1941
Selsam, Millicent, YOU AND THE WORLD AROUND YOU, Doubleday, 1963
Tresselt, Alvin, WAKE UP, CITY, Lothrop, 1957
Tresselt, Alvin, WHITE SNOW, BRIGHT SNOW, Lothrop, 1956
Udry, Janice, TREE IS NICE, Harper, 1956

Lubell, Winifred and Cecil, THE TALL GRASS ZOO, Rand McNally; 1960

An imaginative book that presents the variety of things which are living in the grass, and the interrelationships which exist between them. Brightly colored illustrations.

McCord, David, EVERYTIME I CLIMB A TREE, Little Brown, 1967

Poems about the seasons, the sights and sounds of nature, familiar objects and childhood problems and experiences. Colorful illustrations by Marc Simont.

McGinley, Phyllis, ALL AROUND THE TOWN, Lippincott, 1948

An alphabet picture book of city sights and sounds in gay verse. Double spread, modern impressionistic illustrations by Helen Stone. Could be used to start children off on their own class or individual alphabets of sights and sounds.

O'Neill, Mary, HAILSTONES AND HALIBUT BONES: Adventures in Color, Doubleday, 1961

Clever imagery and word play in verses heightened by Leonard Weisgard's illustrations. Lends itself to art and language arts as well as natural history.

Pitt, Valerie, LET'S FIND OUT ABOUT THE CITY, Watts, 1968

A simple text and attractive illustrations depict the complexities of city life. Economic interdependence is brought out, along with laws and services.

Radlauer, Edward and Ruth, WATER FOR YOUR COMMUNITY, Elk Grove Press, 1968

Excellent material on the water cycle, purification, flood control, and pollution and its prevention. Appealing format with stylized, blue and black illustrations.

Selsam, Millicent, SEE THROUGH THE FOREST, Harper, 1956

Emphasis is on the balance of nature. The levels of the forest are compared with the floors of a tall building. The animals at each level are described and the conditions which keep them there. SEE THROUGH THE SEA is similar in format and equally useful.

Webber, Irma, BITS THAT GROW BIG: WHERE PLANTS COME FROM, Scott, 1949

Introduces plant reproduction with simple text and good illustrations. Experiments are outlined which demonstrate the role of water, air temperature and light in the development and growth of plants. Other titles on plants by the same author for this age group: UP ABOVE AND DOWN BELOW, Scott, 1943; TRAVELER'S ALL, Scott, 1944.

Zim, Herbert S., WHAT'S INSIDE OF PLANTS? Morrow, 1953

A general discussion of plants and their roots, stems, leaves, flowers and fruits. In each section there is a page in large type, intended for beginners, followed by an excellent illustration, and then a page in smaller type with slightly more advanced information. Very useful to teachers as well as children.

Zolotow, Charlotte, STORM BOOK, Harper, 1952

The impressive illustrations, full of motion, and the descriptive text detail the build-up of a summer rainstorm and its effect in the country, in the city, at the seashore and in the mountains. Story book approach, suitable for reading aloud.

BOOKS FOR TEACHERS - ACTIVITY GUIDES

Bale, Robert O., CONSERVATION FOR CAMP AND CLASSROOM, Burgess, 1962

Contains many useful but simple activities, demonstrations and experiments, covering not only conservation, but all aspects of nature study including crafts using native materials. Selected bibliography at end of text based on type of material included in book.

Blough, Glenn O. and Marjorie H. Campbell, MAKING AND USING CLASSROOM SCIENCE MATERIALS, Holt, 1954

All the constructions are simple enough to be carried out by elementary school pupils and the materials are readily available, usually at no cost. Drawings made from actual constructions built in classroom. Each chapter lists "Resources to be Investigated" which can be found in the community. "For Further Information," suggests reading for enrichment.

Brown, Vinson, HOW TO MAKE A HOME NATURE MUSEUM, Little Brown, 1954

The teacher looking for practical ideas for starting a small nature museum in the classroom will find that this book contains a wealth of information. Several other books by Brown will be helpful to teachers: HOW TO MAKE A MINIATURE ZOO, HOW TO EXPLORE THE SECRET WORLDS OF NATURE, HOW TO FOLLOW THE ADVENTURES OF INSECTS.

Comstock, Anna B., HANDBOOK OF NATURE STUDY, Cornell University Press, 1939

A classic among general nature activity books, written by an elementary school teacher for teachers. Nature activities, for indoors and outdoors, described in detail. Drawback in that interrelationships are not emphasized, but does contain materials that cannot be found elsewhere, e.g. domestic animals.

Cooper, Elizabeth K., SCIENCE IN YOUR OWN BACKYARD, Harcourt, 1958

Elementary activities that will be useful to a teacher in the primary grades and can be used by the pupils themselves in the middle grades. SCIENCE ON THE SHORES AND BANKS, a similar format by the same author.

Hammerman, Donald R. and William H., TEACHING IN THE OUTDOORS, Burgess, 1964

Defines outdoor education and its relation to the school curriculum. Gives specific activities and techniques for teaching in the outdoors that relate to language arts, social studies, mathematics, etc. at all grade levels.

Hillcourt, William, FIELD BOOK OF NATURE ACTIVITIES AND CONSERVATION, Putnam, 1961

Covers all aspects of nature study with countless detailed suggested activities and projects. A "Project Index" lists 400 additional projects particularly suited for group work, graded according to degree of knowledge, effort and required equipment.

Hug, John W. and Phyllis J. Wilson, CURRICULUM ENRICHMENT OUTDOORS, Harper and Row, 1965

More than 350 suggestions for outdoor activities to enrich every area of the curriculum. A listing of activities by grade level (1-9) is a useful addition.

Stapp, William B., INTEGRATING CONSERVATION AND OUTDOOR EDUCATION INTO THE CURRICULUM (K-12), Burgess, 1965

Description of the development of an environmental education program in a public school system. Nine guiding principles listed. Analyses of themes, understandings, and sub-understandings for each grade level. Appendices give samples of material used in both elementary and secondary phases of the program.

Wensburg, Katherine, EXPERIENCES WITH LIVING THINGS: AN INTRODUCTION TO ECOLOGY FOR FIVE-TO EIGHT-YEAR-OLDS, Boston, Beacon Press, 1966

An "experience first" approach to ecology with a rich variety of suggestions for explorations and activities stressing the interrelationships in nature. A story concludes each topic. Excellent bibliographic references are listed for each experience.

BOOKS FOR TEACHERS - BACKGROUND READING

Buchsbaum, Ralph and Mildred, BASIC ECOLOGY, Boxwood, 1957

As the title indicates, a basic introduction to ecology for beginners in the field. Useful bibliography that includes journals and textbooks as well as titles under special aspects of ecology.

Farb, Peter and the Editors of Life, ECOLOGY, Time, 1963

Excellent introduction to ecology covering all aspects of plant-animal-man relationships. Final chapter deals briefly with historic attitudes toward ecological concepts and current awareness of need for conservation measures. Many full page illustrations throughout make this useful for browsing for all age groups. A map and descriptive notes of the major biomes of the world appear at the end of text. Also a bibliography with classified entries.

Storer, John, WEB OF LIFE, New American Library, 1956

Explains in simple language and with great clarity the complex term "Balance of Nature."

ENVIRONMENTAL EDUCATION BIBLIOGRAPHY

For Grades 4 through 6

Environmental education is concerned with the nature of man, the nature of the biosphere in which we live and the interrelationships that exist between man and biosphere.

In a day and age when the results of the human arrogance, which sets man outside of the beautifully interrelated systems of nature, are violently apparent in the form of pollution, over-population with its many resultant strifes, environmental degradation and over-exploitation of limited resources, it is imperative that people become educated to the point of a basic environmental literacy. It is a task for the total educational continuum. Teachers and interpreters at every level will have to do their part.

In grades 4 to 6, children are pulling together many previous experiences and blending them with new ones in the formation of basic concepts and conceptual schemes. Emphasis can be placed on helping the youngsters analyze their experiences and synthesize them. They need many concrete examples from which to make their basic abstractions.

This series of AIDS was compiled for the U. S. Office of Education by the Library staff of the Hatheway School of Conservation Education, the education division of the Massachusetts Audubon Society. They represent a select, rather than comprehensive, listing of materials prepared for the information and convenience of teachers. Selection of material for these lists does not constitute official endorsement or approval of it by either Massachusetts Audubon Society or the U. S. Office of Education, to the exclusion of others which may be suitable.

CURRICULUM MATERIALS

CONSERVATION AND SCIENCE CENTER, Browns Mills, NJ 08015

Excellent materials on environment and pollution with an interdisciplinary emphasis.

ENVIRONMENTAL EDUCATION PROGRAM, Dean Bennett, coordinator, Yarmouth, ME

A theme environment has been chosen for each grade level "Within the theme environment, students will be encouraged to interact with the environment or utilize resources in interesting ways, and in so doing they will become aware of, or guided in, the identification of past, present, or pending physical environmental problems."

Grades K-1 Theme: The School; Grades 2-3 Theme: Neighborhood; Grades 4-5 Theme: The Community; Grade 6 Theme: The Region. Teachers' guides are available for each grade. These are in two parts. The first treats individual units; the second gives background information for the teacher.

IF YOU LIVE IN THE CITY - WHERE DO YOU LIVE?

Five 30-minute color television programs, teacher's guide, and 25 activity cards for student use. Series developed by WGBH Education Foundation in Boston. The materials stress the child's place in the urban ecology. Also available on 16mm film.

MAN: A COURSE OF STUDY, Social Studies Curriculum Project, Education Development Center

This fifth grade course seeks to answer the question: "What is human about human beings?" The course, as developed to date, is available for purchase under "controlled conditions" which means teachers must attend a National Science Foundation Workshop and schools must purchase the necessary materials. The course has a conceptual structure of knowledge. Through the study of salmon, herring, gulls, baboons, and finally the Netsilik Eskimos, the students perceive the continuity from animal to man on the themes of "life cycle," "learning," "parenthood," and "social organizations." A distinctive part of the course is the variety of instructional materials, both printed and audio-visual. The films and slides are superb.

OPERATION NEW YORK: Using the Natural Environment of the City as a Curriculum Resource, Board of Education, New York City, 1960

Valuable suggestions for teachers in any urban area. "The interrelationships of living things, including man, with their physical surroundings are understood as boys and girls explore the many 'little environments' found within the city."

PEOPLE AND THEIR ENVIRONMENT: Teacher's Curriculum Guides to Conservation Education, Matthew J. Brennan, ed., J. C. Ferguson Publishing Co.

A K-12 curriculum developed from the Conservation Curriculum Improvement Project of Department of Education, State of South Carolina. Elementary School teachers will be particularly interested in the four volumes covering grades 1 through 9 and the "Outdoor Laboratory" volume for grades 1 through 12.

A PLACE TO LIVE, National Audubon Society, 1970

A new study program in Urban Ecology for Grades 4, 5, and 6. The student's text is in workbook format covering basic ecological concepts as found in any urban environment. "Try This" activities call for both classroom and outdoor lessons. The Teacher's Manual includes, in addition to the "Try This" activities, many suggestions for supplementary experiences. Many of these indicate ways of correlating "A Place to Live" with language arts, social studies, mathematics and art.

POND WATER, Elementary Science Study, Educational Development Center, Newton, MA

This is a unit developed for the 5th grade to extend over a period of at least 5 or 6 weeks, introducing children to the variety of pond life. There are 2 sets of cards: (1) Method cards carry helpful information about keeping pond water animals alive, making good slides, etc.; (2) Animal and plant cards which identify and describe individual animals and plants that children may find in their pond water. This is an unstructured unit with emphasis on observation and inquiry. The teacher's guide contains background information and suggestions for activities.

SCIENCE CURRICULUM IMPROVEMENT STUDY (SCIS), Robert Karplus, director, Lawrence Hall of Science, University of California, Berkeley

This is an ungraded sequential physical and life science program for the elementary school. The teaching strategy is for children to explore selected science materials. They are encouraged to investigate, to discuss what they observe, and to ask questions. The SCIS teacher has two functions: to be an observer and to be a guide. Materials are of four types: (1) Teacher's Guide, (2) Pupil Manuals, (3) Laboratory Materials, (4) Films. Titles of some of the units now available in commercial editions from Rand McNally: Material Objects, Organisms, Interaction and Systems, Life Cycles, Populations.

THE SOCIAL SCIENCES: CONCEPTS AND VALUES, Harcourt, 1970

This K-6 series is one of the best of the very few social studies texts emphasizing basic ecological concepts. "Concepts and values -- the concepts of man as a social being, and the values that make him human -- are the substance of this program."

SCIENCE AND HISTORY, Nuffield Junior Science, SRA, Canada, 1967

This illustrated Teacher's Background Booklet suggests many ways in which history can be made more significant and exciting for elementary children. The author suggests "Ideas to Explore" such as the "Scientist in Early Man," in which children explore the basic problems early man faced in finding food and shelter. Another exploration, "Cave Artists" leads children to try painting with natural materials and potting with native clays. CAVES OF THE GREAT HUNTERS by Hans Baumann would be useful here.

FILMS

BEAVER DAM, color, 15 min., McGraw-Hill Films

The beaver is shown in its natural habitat as he constructs dams, floods farmer's fields, and is saved by two boys from farmer's wrath. Excellent photography, unusual close-ups and a catchy theme song combine to make this film a happy learning experience. Curr. area - natural study

CONSERVATION -- A JOB FOR YOUNG AMERICA, color, 18 min., McGraw-Hill Films

A folk singer supplies the mood as young people become aware of how their land is being despoiled. They are concerned and are prompted into action to do something about it.

IF YOU LIVE IN THE CITY, WHERE DO YOU LIVE? National Instructional Television Center, Box A, Bloomington, IN 47401

Five 30-minute color television programs, teacher's guide, and 25 activity cards for student use. Series developed by WGBH Educational Foundation in Boston. The materials stress the child's place in the urban ecology. Also available on 16mm film.

A NATION OF SPOILERS, color, 11 min., Encyclopaedia Brittanica

Our growing problem of vandalism and littering is a national disgrace. Each one of us can help correct this situation. This film gives the youngsters some ideas on how this can be done.

FILM LOOPS

Ealing Film Loops, 2225 Massachusetts Avenue, Cambridge, MA 02140

These are single concept color films in a convenient cartridge. There is no sound track making it possible to adapt them to each teacher's use. The quality is generally very good. They cover a wide variety of subjects, making these easy-to-use films a valuable teaching tool. The following are a few of the many titles available: URBAN ECOLOGY, BACKYARD ECOLOGY, BIRDS AND THEIR WAY OF LIFE, FAMILIAR INSECTS.

FILMSTRIPS

CONSERVATION IN THE CITY, 52 frames, silent, color, $6 each, $18 per set, Encyclopaedia Britannica

Part I - Underfoot; Part II - Eye level; Part III - Overhead. A new and interesting approach to looking at the city environment. Each film presents a number of different areas for study and discussion; nature study, ecology, conservation and problems (pollution) are some of these. Color is very good as are the questions and suggestions for activities. Some of the vocabulary may need explaining. Curr. area -- general science, social studies, nature study.

ECOLOGY SERIES, 52 frames, silent, color, $7, McGraw-Hill

Series Titles: Physical Environment, Ecological Succession, The Forest as a Community, The Field as a Community, The Pond as a Community, The City as a Community. Presents variety of ecological communities with their plant and animal relationships. Many definitions develop succession and many basic concepts. Good questions and activities suggested. Useful for comparison with other films in set as introduction to subject or as a review. Can be adapted for use at lower grade level. Curr. area -- social studies, science.

EXPLORING THE WORLD OF NATURE, Society for Visual Education, 49 frames, silent, color, $6.50, $36 per set

Series Titles: Let's Explore a Field, Let's Explore a Garden, Let's Explore a Lawn, Let's Explore a Pond, Let's Explore a Stream, Let's Explore a Woodland. Introducing a variety of plants and animals in their natural setting and their relationship to their environment. Vocabulary level consistent - good questions and ideas for further exploration. Useful prior to field trips as an introduction to study of plants and animals or discussion. Curr. area -- natural history, social studies.

NATURE'S HALF ACRE, 48 frames, True-Life Adv. Series, silent, color, $6, Encyclopaedia Britannica

Some plants and animals that may be found in a small area. Excellent photography shows beauty of nature. Can be used as a part of nature study unit or as introduction to field trip. Curr. area -- nature study.

PLANT AND ANIMAL RELATIONSHIPS, 55 frames, silent, color, $6 each, $36 per set, Encyclopaedia Britannica

Series Titles: The Grassland: Story of a Major Community; The Swamp: Some Relations Between Organisms; The Desert: An Example of Adaptations; The Seashore: A Continually Changing Environment; The Pond: How Living Things Change Their Environment; The Forest: A Stable Community.

These films present two basic ideas; that all organisms are part of independent living systems called communities and that they are especially adapted to their particular environment. The charts and diagrams are very usable and the suggestions for further study and discussion very good. Curr. area -- science, nature study.

WHAT WE NEED, WHERE WE FIND IT, HOW WE GET IT, 34 frames, Series: Natural Resources and You, silent, color, $6.00 each, $18 per set, Encyclopaedia Britannica

What natural resources we need to survive, where and how we get them are discussed in these films. Good questions and accompanying manual should lead to further study of subject. The paper puppets are not especially appealing, but information is good. Could be used in primary, but vocabulary might be difficult. Curr area -- science, social studies.

GRAPHICS

CONSERVATION POSTER SET, J. Weston Walch, Publisher, Portland, ME 04104

Each poster carries a large illustration and a thought-provoking commentary. Posters in each set are coordinated to give a survey of the area under study. 18 posters per set 11" x 14". The sets include such titles as Ecology of the City, Conservation of Wildlife and Air Pollution.

ECOLOGY WHYS, Carnegie Museum, 4400 Forbes Ave., Pittsburgh, PA 15213

Two sets, of six charts each, on heavy cardboard, 20" x 24". Charts cover such subjects as Animal Homes in Trees, Soil -- How It Is Made, What Good Are Trees, Succession on a Fallen Log. Accompanying teacher's manuals contain a lesson plan, followup activities, a glossary and a reading list.

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This poster series was designed for use by teachers and pupils of elementary grades. The teacher's guide provides background information and suggested activities for each poster. Another series, similar in format, is entitled, Eco-Problems.

LIFE EDUCATION REPRINTS, Life Educational Reprint Program, Box 834, Radio City Post Office, New York City, NY 10019

The editors of Life have reprinted many of the pictorial essays for use in schools. The series from the World We Live In is an excellent source of pictures for ecological studies at any grade level. The two latest reprints are concerned with the environmental crisis -- #69, Air Pollution and #76, Water Pollution.

STUDY PRINTS, Society for Visual Education, $8 per set

18" x 13" photographs on heavy stock in [illegible]s of 8. On the reverse of each print is factual information, questions, and suggestions for use. The color is in general good, with the exception of the set Common Rocks and Minerals. Size relationships, especially on the animal prints are deceptive. The Basic Science Series covers plants, animals, cloud forms and land forms of running water. Urban Life Series introduces the child to some of the ways the people of the city work and play. Most of the prints can be adapted to use through Grade 6.

RECORDINGS

The following recordings can be used at any grade level, as a prelude to a field trip, or as a follow-up. Children should be encouraged to make their own recordings and these records could be used to suggest possibilities.

BIRDS ON A MAY MORNING, Droll Yankees, Promfret, VT

Side A takes you on a bird walk with commentary through fields, orchards, woods and swampy places. Side B gives same walk without commentary. Identifies 36 bird songs.

THE SWAMP IN JUNE, Droll Yankees, Promfret, VT

The many sounds of the swamp are heard on this record. Birds provide the background melody, while the insects add rhythm and continuity.

COMMON BIRD SONGS, Dover

Sixty of the most common birds of the Eastern United States are identified. A 32-page booklet illustrates each bird.

VOICES OF THE NGHT, Houghton Mifflin

The calls of 34 frogs and toads of the United States and Canada.

THE SONGS OF THE INSECTS, Houghton Mifflin

Calls of the common crickets, grasshoppers, and cicadas of the Eastern United States.

BIRD SONGS IN LITERATURE, Cornell Laboratory of Ornithology

A high-fidelity record of bird songs and the poems they have inspired from Chaucer to Eliot.

SYMPHONY OF THE BIRDS, Ficker Records, Old Greenwich, CT

A symphony in three movements has been created using the song of the birds.

VOICE OF THE SEA, Droll Yankees, Promfret, VT

On Side A are the sounds of the harbor and the sea, and Side B has the sounds of the surf.

GOD BLESS THE GRASS, Columbia Records

Pete Seeger's parodies on conservation are good listening -- folk guitar background.

BOOKS FOR STUDENTS

Amos, William H., THE LIFE OF THE SEASHORE, McGraw-Hill, 1966

This is one volume in the series OUR LIVING WORLD OF NATURE. Each book deals with an American biome, such as the forest, the seashore, or the desert and leads the reader to an understanding of interrelationships within the biome. Written in an easy-to-follow, lively style. The illustrations, charts and diagrams aid greatly in making this a most useful resource set. In the appendix of each of these books you will find a glossary, a bibliography, guides to identification and ideas for science activities. A teacher's guide is available.

Bauer, Helen, WATER: RICHES OR RUIN, Doubleday, 1959

Broad introduction to wise utilization of natural resources. Emphasizes water as a basic and indispensable yet, exhaustible resource. Useful for lead-up to unit on pollution. Good photographs.

Behn, Harry, Comp. and Tr., CRICKET SONGS: JAPANESE HAIKU, Harcourt, Brace, and World, 1964

This book, admirably illustrated with carefully chosen pictures by Japanese masters should inspire children to put down their own impressions of nature in haiku form.

Billington, Elizabeth, UNDERSTANDING ECOLOGY, Warne, 1968

A clear and simple study of ecology from how to get ready to be an "explorer" to explanations of the four parts of the ecosystem and how they affect each other. Excellent diagrams, good index. Many practical projects.

Bronson, Wilfred S., FREEDOM AND PLENTY: OURS TO SAVE, Harcourt, 1953

In graphic text and humorous illustrations, the author gives a broad survey of conservation problems - how our natural resources have been wasted and how they can be saved. Cartoon-like illustrations might well inspire a class to draw their own cartoons to dramatize those issues that interest them the most.

Buck, Margaret Waring, IN WOODS AND FIELDS, Abingdon, 1950

Arranged by season and then by habitat, are descriptions of several hundred birds, bugs, small animals, flowers, trees and shrubs. Abundance of black and white illustrations. Useful for children who have not yet learned to use a field guide. Index with Latin names and reading list at end. There are two more books by Buck similar in format: IN PONDS AND STREAMS and IN YARDS AND GARDENS.

Dorian, Edith, ANIMALS THAT MADE U. S. HISTORY, McGraw-Hill, 1964

The importance of wildlife in the development and growth of the U. S. is stressed from the time of the earliest settlers. Use in conjunction with Mason's WILDLIFE OF NORTH AMERICA and Stoutenberg's ANIMALS AT BAY.

Dunning, Steven et al., REFLECTIONS ON A GIFT OF WATERMELON PICKLE AND OTHER MODERN VERSE, Scott Foresman, 1966

A fresh collection of modern verse. Striking photographs are imaginatively matched to subject to make an unusual volume. In "Interpretation" the compilers raise questions about words, effects and meanings of the poems. Language arts and environmental studies wonderfully combined.

Goetz, Delia, ARCTIC TUNDRA, Morrow, 1958

Describes the plant and animal life, including man, of the arctic as well as the physical aspects of the tundra and its climate. Illustrations on every page make this particularly valuable. Social Studies books of this type should be considered a vital part of an environmental education plan.

Green, Ivah, WILDLIFE IN DANGER, Coward-McCann, 1959

Describes 29 extinct or nearly extinct American birds and animals. Population figures are outdated, but could be checked in an encyclopedia. Explains laws protecting wildlife and needs for further controls. Suitable for fourth graders.

Hilton, Suzanne, HOW DO THEY GET RID OF IT? Westminister, 1970

An informative review of the many methods of disposing of things that are no longer useful and of the wastes of modern industry and human living. Some of the methods described and pictured are in current use, some are new developments that have not yet been implemented. A timely presentation for elementary students on environmental pollution. Detailed bibliography. Many photographs.

Hirsch, S. Carl, THE LIVING COMMUNITY: A VENTURE INTO ECOLOGY, Viking, 1966

After tracing the basic concepts of ecology back to Thoreau and Darwin, the text shows how biological needs and environmental conditions determine what species are successful in a particular region. Describes man as the dominant species because of his ability to change his own environment, and explains the far-reaching effects of man's technology. List of suggested reading at end of text. Suitable for sixth graders.

Hofman, Melita, A TRIP TO THE POND: AN ADVENTURE IN NATURE, Doubleday, 1966

Copiously illustrated survey of the life in, over, and around a pond. Particular emphasis on insects with illustrations of life cycles -- dragonfly, caddis fly, mosquito, water beetle. Chart on end papers offers suggestions on how to catch, carry, feed and care for organisms taken from pond for study and observation. Use both before and after a field trip.

Kane, Henry B., THE TALE OF A WOOD, Knopf, 1962

Natural history of a temperate forest. Plants and animals explored in an interesting, instructive manner. Superb photographs and drawings supplement the text. Equally useful and appealing: Tale of a Meadow and Tale of a Pond. These ecological studies provide excellent possibilities for dioramas or student photography projects.

Kavaler, Lucy, DANGEROUS AIR, Day, 1967

Author goes back to the discovery of fire to show how pollution has increased in relation to the advance of civilization and growth in population and describes sources of air pollution, its effects on humans, animals and vegetation and its possible effect on climate. Suitable for 6th grade and up.

Lewis, Alfred, CLEAN THE AIR! FIGHTING SMOKE, SMOG AND SMAZE, McGraw-Hill, 1965

Dramatic presentation of all aspects of air pollution will appeal to children. Problems are illustrated in photographs and diagrams. Potential solutions are offered. Sixth graders will make best use of this.

Lewis, Richard, comp., OUT OF THE EARTH I SING: POETRY AND SONGS OF PRIMITIVE PEOPLES OF THE WORLD, Morton, 1968

According to Mr. Lewis, "These people had and still have secrets about living which our 'civilized' cultures could learn from. Part of their secret is that they have not broken their hold on the rhythms of the earth." Many possibilities for social studies as well as language arts.

Lewis, Richard, comp. THE WIND AND THE RAIN: CHILDREN'S POEMS, Simon and Schuster, 1968

Poems by children complemented by black and white photographs. A stimulus to children and teachers to produce their own book of poetry and photographs as they explore the outdoors.

Mason, George Frederick, THE WILDLIFE OF NORTH AMERICA, Hastings, 1966

Well-illustrated, very readable account which gives a brief history of North American wildlife, reveals some of the situations that caused animals to become extinct and discusses the effects of diminishing natural areas, toxic pesticides and water pollution on animal and plant life. The author emphasizes importance of conservation and describes past and current conservation methods. Includes chart of geological areas, maps of U. S. wildlife refuge systems and Canadian National Parks and a bibliography. 5th grade up.

Pringle, Lawrence P., DISCOVERING THE OUTDOORS: A NATURE AND SCIENCE GUIDE TO INVESTIGATING LIFE IN FIELDS, FORESTS AND PONDS, Natural History Press, 1969

Title accurately describes contents. Each section clearly and simply describes how to set about an elementary ecological study of a particular outdoor area. Excellent black and white photographs, many drawings and diagrams add to usefulness. Bibliography with reading level indicated. Good index. Sound reference material for teacher as well.

Radlauer, Edward and Ruth, WATER FOR YOUR COMMUNITY, Elk Grove Press, 1968

Excellent material on the water cycle, purification, flood control, and pollution and its prevention. Appealing format with stylized, blue and black illustrations.

Russell, Helen Ross, CITY CRITTERS, Meredith, 1969

The author tells how each of these "city critters" contributes to the ecological balance of the city world. Many of the activities in How to Explore the Secret Worlds of Nature by V. Brown could be used in combination with City Critters.

Shuttlesworth, Dorothy, CLEAN AIR - SPARKLING WATER: THE FIGHT AGAINST POLLUTION, Doubleday, 1968

Divided in three parts -- the first, a photographic essay on one town's efforts to clean up the polluted air and water after an inversion caused illness and death. The second section is a brief study of cities in America and abroad with their pollution problems, and lastly there is a section on action. The photographs could be projected without text to introduce a unit on the environment at any grade level. Fourth graders can handle the text.

Simon, Seymour, A HANDFUL OF SOIL, Hawthorn, 1970

Simple experiments, easily read and performed by 4th and 5th graders, that will teach them the physical properties of soil. Useful if used in conjunction with other books on same topic such as Talley's To Save the Soil.

Smith, Frances C., FIRST BOOK OF CONSERVATION, Watts, 1954

Basic introduction to nature's interrelationships; how man has upset the balance in nature, and what he is now doing to conserve natural resources. The section "What You Can Do" gives several suggestions. Glossary, index and books recommended are additional aids. The First Book of Water, also by Frances C Smith, would be useful in a conservation unit.

Stoutenberg, Adrien, EXTINCT AND THREATENED AMERICAN BIRDS, A VANISHING THUNDER, Natural History Press, 1967

The author writes: "The purpose of this book is not to dwell on the total destruction of certain species, except as a warning for the future, but to alert a growing generation to the big job of conservation that remains." This same theme is found in the author's companion volume Animals at Bay: Rare and Rescued American Wildlife, a book which includes land and aquatic mammals. The drawings by John Schoenherr add greatly to the value of both these books. More advanced text than Green's Wildlife in Danger.

Syrocki, John, WHAT IS SOIL? Benefic, 1961

In this colorful, easy-to-read book, different types of soil are explained. Erosion and methods of conservation are also described. Elementary introduction to a natural resource.

Talley, Naomi, TO SAVE THE SOIL, Dial, 1965

Clearly outlines the nature and causes of soil erosion and traces the history of soil conservation efforts in this country down to the present. Detailed description of the U. S. Conservation Service and examples of specific conservation projects throughout the U. S. make this a valuable and informative introduction to the subject. Well illustrated with photographs from the Soil Conservation Service.

Webster, David, SNOW STUMPERS, Natural History Press, 1968

The first section of this book is a collection of black and white photographs, grouped by themes such as Snow Along the Road, Tracks in the Snow, Solid Ice. A stimulating question accompanies each picture. Children should be able to find many other "Snow Stumpers" on their own as they study this aspect of their environment. Answers appear at the end of each theme. The second section describes science activities involving ice and snow.

Youngpeter, John M., WINTER SCIENCE ACTIVITIES: EXPERIMENT AND PROJECTS, Holiday, 1966

Seventy projects concerning all facets of winter, from both the physical and the biological aspects. Written for children but provides many useful ideas for teachers. Could well be used in conjunction with Webster's SNOW STUMPERS.

BOOKS FOR TEACHERS -- ACTIVITY GUIDES

Bale, Robert O., CONSERVATION FOR CAMP AND CLASSROOM, Burgess, 1962

Contains many useful but simple activities, demonstrations and experiments, covering not only conservation but all aspects of nature study, including crafts using native materials. Selected bibliography at end of text based on type of material included in this book.

Blough, Glenn O. and Marjorie H. Campbell, MAKING AND USING CLASSROOM SCIENCE MATERIALS, Holt, 1954

All the constructions are simple enough to be carried out by elementary school pupils and the materials are readily available, usually at no cost. Drawings made from actual constructions built in classroom. Each chapter lists "Resources to Investigate" which can be found in the community. "For Further Information" suggests reading for enrichment.

Brown, Vinson, HOW TO MAKE A HOME NATURE MUSEUM, Little Brown, 1954

The teacher looking for practical ideas for starting a small nature museum in the classroom will find that this book contains a wealth of information. Several other books by Vinson Brown will be helpful to teachers. Students can also use these: How to Make a Miniature Zoo; How to Explore the Secret Worlds of Nature; How to Follow the Adventures of Insects.

Comstock, Anna B., HANDBOOK OF NATURE STUDY, Cornell University Press, 1939

A classic among general nature activity books, written by an elementary school teacher for teachers. Nature activities for indoors and outdoors described in detail. Drawback in that interrelationships are not stressed, but does contain materials that cannot be found elsewhere, e.g. domestic animals.

Cooper, Elizabeth K., SCIENCE IN YOUR OWN BACKYARD, Harcourt, 1958

Elementary activities that will be useful to a teacher in the primary grades and that can be used by the students themselves in the middle grades. SCIENCE ON THE SHORES AND BANKS, a similar format, by the same author.

Hammerman, Donald R. and William H. Hammerman, TEACHING IN THE OUTDOORS

Defines outdoor education and its relation to the school curriculum. Gives specific activities and techniques for teaching in the outdoors that relate to language arts, social studies, mathematics, etc. at all grade levels.

Hillcourt, William, FIELD BOOK OF NATURE ACTIVITIES AND CONSERVATION, Putnam, 1961

Covers all aspects of nature study with countless detailed suggested activities and projects. A "Project Index" lists 400 additional projects particularly suited for group work, graded according to degree of knowledge, effort and equipment required.

Hug, John W. and Phyllis J. Wilson, CURRICULUM ENRICHMENT OUTDOORS, Harper and Row, 1965

More than 350 suggestions for outdoor activities to enrich every area of the curriculum. A listing of activities by grade level (1-9) is a useful addition.

Marsh, Norman F., OUTDOOR EDUCATION ON YOUR SCHOOL GROUNDS, State of California, Office of Conservation Education, 1967

A manual for elementary and junior high school teachers that describes effective learning programs on the school grounds.

Swan, Malcolm D., ed., TIPS AND TRICKS IN OUTDOOR EDUCATION APPROACHES TO PROVIDING CHILDREN WITH EDUCATIONAL EXPERIENCES IN THE OUT-OF-DOORS, Interstate

This paperback manual prepared by members of the Department of Outdoor Teacher Education, Laredo Taft Field Campus, Northern Illinois University, offers many helpful suggestions including one particular chapter on Ecological Studies.

Stapp, William B., INTEGRATING CONSERVATION AND OUTDOOR EDUCATION INTO THE CURRICULUM (K-12), Burgess, 1965

Description of the development of an environmental education program in a public school system. Nine guiding principles listed. Analyses of these, understandings and sub-understandings for each grade level. Appendices give samples of material used in both elementary and secondary phases of the program.

BOOKS FOR TEACHERS -- BACKGROUND READING

Bates, Marston, THE FOREST AND THE SEA: A LOOK AT THE ECONOMY OF NATURE AND THE ECOLOGY OF MAN, Random, 1960

Emphasizes the interaction and interdependence of all things with each other and with their environment. Points up the biological analogy between the forest and the sea.

Buchsbaum, Ralph and Mildred, BASIC ECOLOGY, Boxwood, 1957

As the title indicates, a basic introduction to ecology for beginners in the field. Useful bibliography that includes journals and textbooks as well as titles under special aspects of ecology.

Farb, Peter and the editors of Life, ECOLOGY, Time, 1963

Excellent introduction to ecology covering all aspects of plant, animal, man relationships. Final chapter deals briefly with historic attitudes toward ecological concepts and current awareness of need for conservation measures. Many full-page illustrations throughout make this useful for browsing for all age groups. A map and descriptive notes of the major biomes of the world appear at the end of text. Also a bibliography with classified entries. The other volumes in this Life Nature Library are a valuable addition to any classroom.

Leopold, Aldo, SAND COUNTY ALMANAC: WITH OTHER ESSAYS ON CONSERVATION FROM ROUND RIVER, Oxford University Press, 1966

Probably one of the most quoted books in the field on conservation. A collection of essays that points up the concept of a land ethic and the need for man to recognize his place in relation to the entire community of things organic and inorganic. His essay entitled, "Odyssey," will give teachers, and any student from junior high up an unforgettable understanding of the carbon cycle.

Perry, John, OUT POLLUTED WORLD: CAN MAN SURVIVE? Watts, 1967

The origins, nature and disastrous effects of air and water pollution are examined in detail, as well as what is being done to alleviate the problems. This book offers a broad overview in an easily-read style.

Storer, John, WEB OF LIFE, New American Library, 1956

Explains in simple language and with great clarity the complex term, "Balance of Nature."

ENVIRONMENTAL EDUCATION BIBLIOGRAPHY

For Grades 7 through 9

Environmental education is concerned with the nature of man, the nature of the biosphere in which we live and the interrelationships that exist between man and biosphere.

In a day and age when the results of the human arrogance that sets man outside of the beautifully interrelated systems of nature are violently apparent in the form of pollution, over-population, with its many resultant strifes, environmental degradation and over-exploitation of limited resources, it is imperative that people become educated to the point of a basic environmental literacy. It is a task for the total educational continuum. Teachers and interpreters at every level will have to do their part.

In grades 7 to 9, youngsters are undergoing many physical and psychological changes. They are questioning much including examination of the basic value systems they have so far largely taken for granted. It is, thus, a time to look at broad environmental issues and examine not only the basic concepts needed to deal with them, but the basic assumptions and values that undergird our traditional approaches to them.

This series of AIDS was compiled for the U. S. Office of Education by the library staff of the Hatheway School of Conservation Education, the education division of the Massachusetts Audubon Society. They represent a select, rather than comprehensive, listing of materials prepared for the information and convenience of teachers. Selection of material for these lists does not constitute official endorsement or approval of it by either Massachusetts Audubon Society or the U. S. Office of Education, to the exclusion of others which may be suitable.

CURRICULUM MATERIALS

CONSERVATION AND SCIENCE CENTER, Browns Mills, NJ 08015

Excellent materials on environment and pollution with an interdisciplinary emphasis.

MAN AND HIS ENVIRONMENT, a combined unit -- Earth Science and Environmental Education Program (Civics, grade 9), Dean Bennett, coordinator, Yarmouth, ME

Purpose of this unit is "to develop an understanding and appreciation of the land, water, and air resources in the environment of their region, their dependency upon them, how the resources are managed and used through educational, governmental, economic and technological systems, the associated environmental problems and the responsibility of citizens to seek solutions."

FIELD STUDY MANUAL FOR OUTDOOR LEARNING, Millikin, Margaret, et al., Burgess, 1968

A manual of activities for studying natural resources. The first section deals with mapping the field study area. The following sections detail activities in the study of soil, water, plants, animal life and weather.

PEOPLE AND THEIR ENVIRONMENT: TEACHERS CURRICULUM GUIDES TO CONSERVATION EDUCATION, Matthew J. Brennan, editor, J. C. Ferguson Publishing Co.

A K-12 curriculum developed from the conservation curriculum improvement project of Department of Education, State of South Carolina. Junior high school teachers will find valuable materials in the volumes of 7. 8. 9 Science, 7. 8. 9 Social Studies and in the 1 to 12 Outdoor Laboratory.

OCEANOGRAPHIC FIELD COURSE (grade 8) Oceanographic Educational Center, Box 585, Falmouth, MA 02541

There are 3 principal objectives of the course: (1) to stimulate the interest of young students in the marine sciences, (2) to instruct students in the scientific method of field and laboratory observation and investigation, (3) to take advantage of the interdisplinary nature of oceanography to teach basic principles of general science.

OPERATION NEW YORK: USING THE NATURAL ENVIRONMENT OF THE CITY AS A CURRICULUM RESOURCE, Board of Education, City of New York, 1960

Valuable suggestions for teachers in any urban area. "The interrelationships of living things, including man, with their physical surroundings are understood as boys and girls explore the many 'little environments' which are found within the city."

PROBING THE NATURAL WORLD: ENVIRONMENTAL CRISIS, VOLUME 3-D, Intermediate Science Curriculum Study, 1970, Florida State University, Department of Science

A combination text and workbook for students with striking art work and stimulating activities that call for original thinking and value judgments.

FILMS

BEARGRASS CREEK, color, 19 minutes, Stuart-Finley Productions

This story of a stream is the story of many polluted waterways in our country. The road from clean water to polluted water is only a short distance in time and effort. It is much longer and more difficult to reverse the direction.

CONSERVATION -- A JOB FOR YOUNG AMERICA, color, 18 minutes, McGraw-Hill

A folk singer supplies the mood as young people become aware of how their land is being despoiled. They are concerned and are prompted into action to do something about it.

CONSERVATION AND BALANCE IN NATURE, color, 18 minutes, International Film Bureau

The word "ecology" has become almost a household term without most persons knowing what it means. This film relates, through easily understood examples taken directly from nature, what ecology is. It also examines man's role in effecting balances in biological communities.

THE HOUSE OF MAN -- OUR CHANGING ENVIRONMENT, Black and White, 17 minutes, Encyclopaedia Britannica

Tells how man has changed and spoiled his environment through the waste of natural resources and the pollution of air and water. Suggests ways of preserving the resources.

A MATTER OF TIME, color, 27 minutes, Conservation Foundation

Man first struggled to survive in a hostile environment. Now that he has survived, he is fast destroying the very environment upon which his life depends. Slow start, but otherwise very useful film.

A NATION OF SPOILERS, color, 11 minutes, Encyclopaedia Britannica

Our growing problem of vandalism and littering is a national disgrace. Each one of us can help correct this situation. This film gives the youngsters some ideas on how this can be done.

THE POND AND THE CITY, color, 16 minutes, Encyclopaedia Britannica

Man is rapidly destroying his natural environment and there is an end to our natural resources. Is urbanization worth losing all our natural areas? Can anything be done about it?

POPULATION ECOLOGY, color, 19 minutes, McGraw-Hill

Populations of plants and animals including humans have natural limits that are set by the environment in which they live. There are many factors which affect population and their interactions are complex.

A STRAND BREAKS, color, 15 minutes, Encyclopaedia Britannica

The natural balance of the living community is usually maintained by the interrelationships of all its inhabitants. Man, however, through ignorance and self-interest, often upsets this balance and suffers the drastic results. Emphasizes that man must intelligently manage his environments.

THE STRANDS GROW, color, 15 minutes, Encyclopaedia Britannica

Each life -- plant or animal -- is like a tiny strand in a vast web that binds all living things together, each life having its effect on other lives. Shows how some die out while others develop. Emphasizes importance of a balance in nature.

THE THIRD POLLUTION, color, 30 minutes, National Audio-Visual Center

The ever-increasing problem of solid waste disposal is discussed along with related air and water pollution sources. Some of the new techniques of solid waste management are demonstrated.

WATER AND LIFE, color, 15 minutes, Film Association

Water is important to all living things. Its physical characteristics make it the ideal medium for transport of food and waste products between cells. Describes evolutionary changes as plants and animals left the water to live on land.

FILM LOOPS

Ealing Film-Loops, 2225 Massachusetts Avenue, Cambridge, MA 02140

These are single concept color films in a convenient cartridge. There is no sound track, making it possible to adapt them to each teacher's need. The quality is generally very good. They cover a wide variety of subjects making these easy-to-use films a valuable teaching tool. The following are a few of the many titles available: Urban Ecology, Backyard Ecology, Birds and Their Way of Life, and Familiar Insects.

FILMSTRIPS

AIR POLLUTION AND YOU, Current Affairs Films, 47 frames, silent, color

An up-to-date presentation on how, what, and where air pollution is and how it affects all of us. Photography, graphs and current facts add to this film's usefulness. The questions and ideas for further investigation are very good. (Curriculum area -- social studies, government)

ECOLOGY, McGraw-Hill, 52 frames, silent, color, $7

Series Titles: Physical Environment, Ecological Succession, The Forest as a Community, The Field as a Community, The Pond as a Community, The City as a Community. A variety of presentation on ecological communities with their plant and animal relationships. Many definitions. Develops succession and many basic concepts. Good questions and activities suggested. Can be adapted for use at lower grade level. (Curriculum area -- social studies, science)

CONSERVATION FOR TODAY'S AMERICA, Society for Visual Education, silent or sound, color, $6.50 each, $64.50 per set with records

Series Titles: Soil Conservation Today, Forest Conservation Today, Water Conservation Today, Wildlife Conservation Today, Mineral Conservation Today, Urban Conservation Today, Land Conservation Today. This series deals with the need for the conservation of our natural resources and analyzes the problems arising from that need. Some solutions are given and should generate group discussion and durther study. Good photography. Can be used at all levels if adapted to group. Each film might be used as a course introduction. (Curriculum area -- social studies)

ECOLOGY AND MAN, Set I, McGraw-Hill, 50 frames, silent, color, $8.50 each, $45 per set

Series Titles: Introduction to Ecology, Changes in Eco-systems, Energy Relationships, Habitats and Niches, Populations and Biomes, Adaptations to Environment. This series introduces basic ecological principles and vocabulary and each film develops in sequence a major concept. Excellent color, good questions for discussion. They may be adapted for use according to ability. Manual should be used. Supplementary information and explanation by user is necessary.

ECOLOGY AND MAN, Set II, McGraw-Hill, 50 frames, silent, color, $8.50 each, $45 per set

Series Titles: The Forest Biome - Part I and Part II, The Grassland Biome, The Desert Biome, Freshwater Ecology, Seacoast Ecology. This series shows how the basic ecological principles operate in the major biomes and habitats. Prior knowledge of concepts and terminology is necessary for use of these films. The color is excellent, good discussion material adaptable according to ability. (Curriculum area -- biology)

ECOLOGY AND MAN, Set III, McGraw-Hill, 50 frames, silent, color, $8.50 each, $45 per set

Series Titles: Man-Managed Ecosystems, The Management of Water, The Management of Soil, The Ecology of Farming, Competitive Land Uses, Human Ecology. Presented in this series are man's successes and failures in managing nature for his own benefit, and problems presented by the failures. Users should be familiar with basic ecological principles and terminology. Manual has good discussion questions and suggestions for activities and further reading. (Curriculum area -- biology, ecology)

ENVIRONMENTAL POLLUTION -- OUR WORLD IN CRISIS, Ward's, 64 frames, silent, color, $6 each, $36 per set

Series Titles: Nature of the Crisis, Atmospheric Pollution, Land Pollution, Freshwater Pollution, Marine Pollution, Pollution. Content of filmstrips covers subject well. Very informative, good questions should lead to discussion. Introduces references for further study. Environmental vocabulary is introduced and some of the concepts will require additional study. Must be used with very good accompanying manual and by someone with background in environmental problems. (Curriculum area -- science and social studies)

PLANT AND ANIMAL RELATIONSHIPS, Encyclopaedia Britannica, 55 frames, silent, color, $6 each, $36 per set

Series Titles: The Grassland: Story of a Major Community; The Swamp: Some Relations Between Organisms; The Desert: An Example of Adaptations; The Seashore: A Continually Changing Environment; The Pond: How Living Things Change Their Environment;

The Forest: A Stable Community. These films present two basic ideas; that all organisms are part of independent living systems called communities and that they are especially adapted to their particular environment. The charts and diagrams are very usable, and the suggestions for further study and discussion very good. (Curriculum area -- science, nature study)

WHAT WE NEED, WHERE WE FIND IT, HOW WE GET IT, Encyclopaedia Britannica, 34 frames, Series: Natural Resources and You, silent, color, $6 each, $18 per set

What natural resources we need to survive, where and how we get them are discussed in these films. Good questions and accompanying manual should lead to further study of subject. The paper puppets are not especially appealing, but information is good. (Curriculum area -- science, social studies)

GRAPHICS

CONSERVATION POSTER SET, J. Weston Walch, Publisher, Portland, ME 04104

Each poster carries a large illustration and a thought-provoking commentary. Posters in each set are coordinated to give a survey of the area under study. 18 posters per set, 11" x 14". The sets include such titles as Ecology of the City, Conservation of Wildlife, Air Pollution.

HENRY GIBSON ECOLOGY POSTERS, Synergisms, P. O. Box 671, Novato, CA 94947

Six colorful 2' x 3' posters that will delight Henry Gibson admirers. Also put across a worthwhile message on eco-pollution.

INSTRUCTOR ECOLOGY POSTER SETS, Instructor Publications Inc., 1970

This poster series was designed for use by teachers and pupils of elementary grades. The teacher's guide provides background information and suggested activities for each poster. Another series, similar in format, is entitled Eco-Problems.

LIFE EDUCATIONAL REPRINTS, Life Educational Reprint Program, Box 834, Radio City Post Office, New York, NY 10019

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THE SWAMP IN JUNE, Droll Yankees, Promfret, VT

The many sounds of the swamp are heard on this record. Birds provide the background melody, while the insects add rhythm and continuity.

COMMON BIRD SONGS, Dover

Sixty of the most common birds of the eastern United States are identified. A 32-page booklet illustrates each bird.

VOICES OF THE NIGHT, Houghton Mifflin

The calls of 34 frogs and toads of the United States and Canada.

THE SONGS OF THE INSECTS, Houghton Mifflin

Calls of the common crickets, grasshoppers, and cicadas of the eastern United States.

BIRD SONGS IN LITERATURE, Cornell Laboratory of Ornithology

A high-fidelity record of bird songs and the poems they have inspired from Chaucer to Eliot.

SYMPHONY OF THE BIRDS, Ficker Records, Old Greenwich, CT

A symphony in three movements has been created using the songs of the birds.

VOICE OF THE SEA, Droll Yankees, Promfret, VT

On Side A are the sounds of the harbor and the sea, and side B has the sounds of the surf.

GOD BLESS THE GRASS, Columbia Records

Pete Seeger's parodies on conservation are good listening -- folk guitar background.

BOOKS FOR STUDENTS

Amos, William H., THE LIFE OF THE SEASHORE, McGraw-Hill, 1966

This is one volume in the series OUR LIVING WORLD OF NATURE. Each book deals with an American biome, such as the forest, the seashore, or the desert, and leads the reader to an understanding of interrelationships within the biome. Written in an easy-to-follow, lively style. The illustrations, charts and diagrams aid greatly in making this a most useful reference set. In the appendix of each of these books you will find a glossary, a bibliography, guides to identification and ideas for science activities. A teacher's guide is available.

Aylesworth, Thomas, THIS VITAL AIR, THIS VITAL WATER: MAN'S ENVIRONMENTAL CRISIS, Rand McNally, 1968

Covers air, water and noise pollution in various parts of the world, including U. S. Author urges young people to consider careers in pollution control and indicates the types of positions open to them as scientists, engineers, technicians or clerical workers.

Behn, Harry, comp. and tr., CRICKET SONGS: JAPANESE HAIKU, Harcourt, Brace, and World, 1964

This book, admirably illustrated with carefully chosen pictures by Japanese masters, should inspire children to put down their own impressions of nature in haiku form.

Billington, Elizabeth, UNDERSTANDING ECOLOGY, Warne, 1968

A clear and simple study of ecology from how to get ready to be an "explorer" to explanations of the four parts of the ecosystem and how they affect each other. Excellent diagrams, good index. Many practical projects.

Darling, Lois and Louis, A PLACE IN THE SUN: ECOLOGY AND THE LIVING WORLD, Morrow, 1968

An analysis of various types of ecosystems and the inherent danger of man upsetting these natural interrelationships through the effects of pesticides, deforestation and pollution. Excellent diagrams, drawings and photographs. Suggestions for further reading are starred in the bibliography. More technical than Hirsch's LIVING COMMUNITY.

Davies, Delwyn, FRESH WATER, Natural History Press, 1969

Description of the special chemical and physical properties that account for water's dominant position in the living world and the relevance of these properties to man's own physiological processes. Excellent illustrations. Nature and Science Library

Dunning, Steven, et al., REFLECTIONS ON A GIFT OF WATERMELON PICKLE AND OTHER MODERN VERSE, Scott Foresman, 1968

A fresh collection of modern verse. Striking photographs are imaginatively matched to subject to make an unusual volume. In "Interpretation" the compilers raise questions about words, effects and meanings of the poems. Language arts and environmental studies wonderfully combined.

Harlow, William M., PATTERNS OF LIFE, Harper, 1966

The study of man's environment should certainly encompass art. Here is a collection of striking black and white photographs of plant life, as seen through a hand lens, that reveals the plan and symmetry of growing things. These plant patterns could provide students and teachers with new and exciting departures for creative expression. Material for mathematics is also here in the study of symmetry and spirals.

Hirsch, S. Carl, THE LIVING COMMUNITY: A VENTURE INTO ECOLOGY, Viking, 1966

After tracing the basic concepts of ecology back to Thoreau and Darwin, the text shows how biological needs and environmental conditions determine what species are successful in a particular region. Describes man as the dominant species because of his ability to change his own environment and explains the far-reaching effects of man's technology. List of suggested reading at end of text. Suitable for 6th graders.

Joffe, Joyce, CONSERVATION, Natural History Press, 1970

Emphasizes interrelationships and necessity for man to apply ecological principles to our own species, in particular by stabilizing human populations. This is one volume in the Nature and Science Library published for the American Museum of Natural History. Original art, photographs, maps and charts -- many in full color -- amplify the text. Vocabulary is difficult, but books will be valuable for reference. Other titles that would be particularly useful: Man's Impact on Nature, Man, Nature and History and Nature's Network.

Kavaler, Lucy, DANGEROUS AIR, Day, 1967

Author goes back to the discovery of fire to show how pollution has increased in relation to the advance of civilization and growth in population and describes sources of air pollution, its effects on humans, animals and vegetation, and its possible effect upon climate. Suitable for 6th graders and up.

Landsberg, Hans H., NATURAL RESOURCES FOR U. S. GROWTH: A LOOK AHEAD TO THE YEAR 2000, John S. Hopkins Press, 1964

A study of America's needs up to the year 2000, and of supplies available to meet the demand. Useful reference for both teacher and student.

Lewis Alfred, CLEAN THE AIR! FIGHTING SMOKE, SMOG AND SMAZE, McGraw-Hill, 1965

Dramatic presentation of all aspects of air pollution will appeal to children. Problems are illustrated in photographs and diagrams. Potential solutions are offered.

Lewis, Richard, comp., OUT OF THE EARTH I SING: POETRY AND SONGS OF PRIMITIVE PEOPLES OF THE WORLD, Norton, 1968

According to Mr. Lewis, "These people had and still have secrets about living which our 'civilized' cultures could learn from. Part of their secret is that they have not broken their hold on the rhythms of the earth." Many possibilities for social studies as well as language arts.

Liston, Robert A., DOWNTOWN: OUR CHALLENGING URBAN PROBLEMS, Delacorte, 1968

A searching look at metropolitan areas and at rehabilitation as a "problem of people, not of cities" that deals with such subjects as education, urban renewal, health and transportation.

Mason, George Frederick, THE WILDLIFE OF NORTH AMERICA, Hastings, 1966

Well-illustrated, very readable account which gives a brief history of North American wildlife, reveals some of the situations that caused animals to become extinct and discusses the effects of diminishing natural areas, toxic pesticides and water pollution on animal and plant life. The author emphasizes importance of conservation and describes past and current conservation methods. Includes chart of geological areas, maps of U. S. wildlife refuge systems and Canadian National Parks, and a bibliography. 5th grade up.

Munzer, Martha, PLANNING OUR TOWN, Knopf, 1964

Introduces students to the problems of urban planning. Emphasizes the fact that no community is "an island unto itself" so students will consider their town and city as part of a larger community. At end of the text is a list of colleges that offer degrees in the planning profession and a bibliography.

Navarra, John G., OUR NOISY WORLD, Doubleday, 1969

Discusses the newest type of social problem - noise pollution - that makes its impact on our mental, physical and emotional well-being. Illustrated with an abundance of black and white photographs.

Raskin, Edith, THE PYRAMID OF LIVING THINGS, McGraw-Hill, 1967

Detailed description of environmental adaptation and interdependence of plants and animal life in major ecological communities of the world. Cites man as both a destroyer and preserver of balance of nature. Emphasizes need for conservation to assure mankind of a liveable environment. Includes map of world biomes, charts and suggestions for further reading.

Pringle, Laurence P., DISCOVERING THE OUTDOORS: A NATURE AND SCIENCE GUIDE TO INVESTIGATING LIFE IN FIELDS, FORESTS AND PONDS, Natural History Press, 1969

Title accurately describes contents. Each section clearly and simply describes how to set about an elementary ecological study of a particular outdoor area. Excellent black and white photographs, many drawings and diagrams add to usefulness. Bibliography with reading level indicated. Good index. Sound reference material for teacher as well.

Russell, Helen Ross, CITY CRITTERS, Meredith, 1969

The author tells how each of these "city critters" contributes to the ecological balance of the city world. Many of the activities in How To Explore the Secret Worlds of Nature by V. Brown could be used in combination with City Critters.

Stoutenberg, Adrien, ANIMALS AT BAY: RARE AND RESCUED AMERICAN WILDLIFE, Doubleday, 1968

A timely and comprehensive account of animals threatened with extinction today. Illustrated with striking drawings by John Schoenherr. Another book by Stoutenberg deals with birds - A VANISHING THUNDER: EXTINCT AND TREATENED AMERICAN BIRDS.

Schwartz, Alvin, OLD CITIES AND NEW TOWNS: THE CHANGING FACE OF THE NATION, Dutton, 1968

A text that provides practical information on contemporary city problems and future trends. Numerous photographs, maps and diagrams enhance the text.

Worth, Jean, MAN, EARTH AND CHANGE: THE PRINCIPLES AND HISTORY OF CONSERVATION, Coward-McCann, 1968 (new conservation series)

Solid discussion of the history and principles of conservation with an "environmental" message.

In this same series, The Air We Live In and Air Pollution: What We Must Do About It by James Marshall would be equally useful to both teachers and students. Both of these texts are well-illustrated.

BOOKS FOR TEACHERS --ACTIVITY GUIDES

Buchsbaum, Ralph and Mildred, BASIC ECOLOGY, Boxwood, 1957

As the title indicates, a basic introduction to ecology for beginners in the field. Useful bibliography that includes journals and textbooks as well as titles under special aspects of ecology.

Hammerman, Donald R. and William H. Hammerman, TEACHING IN THE OUTDOORS, Burgess, 1964

Defines outdoor education and its relation to the school curriculum. Gives specific activities and techniques for teaching in the outdoors that relate to language arts, social studies, mathematics, etc. at all grade levels.

Hillcourt, William, FIELD BOOK OF NATURE ACTIVITIES AND CONSERVATION, Putnam, 1961

Covers all aspects of nature study with countless detailed suggested activities and projects. A "Project Index" lists 400 additional projects particularly suited for group work, graded according to degree of knowledge, effort and equipment required.

Stapp, William B., INTEGRATING CONSERVATION AND OUTDOOR EDUCATION INTO THE CURRICULUM (K-12), Burgess, 1965

Description of the development of an environmental education program in a public school system. Nine guiding principles listed. Analysis of themes, understandings and subunderstandings for each grade level. Appendices give samples of material used in both elementary and secondary phases of the program.

Smith, Robert L., ECOLOGY AND FIELD BIOLOGY, West Virginia University, 1966

A college text in ecology which is a valuable reference for a teacher. Contains a multitude of illustrations, charts and diagrams, plus voluminous bibliographic references.

Swan, Malcolm D., ed. TIPS AND TRICKS IN OUTDOOR EDUCATION: APPROACHES TO PROVIDING CHILDREN WITH EDUCATIONAL EXPERIENCES IN THE OUT-OF-DOORS, Interstate

This paperback manual prepared by members of the Department of Outdoor Education, Laredo Taft Field Campus, Northern Illinois University, offers many helpful suggestions including one particularly helpful chapter on Ecological Studies.

BOOKS FOR TEACHERS -- BACKGROUND READING

Bates, Marston, THE FOREST AND THE SEA: A LOOK AT THE ECONOMY OF NATURE AND THE ECOLOGY OF MAN, Random, 1960

Emphasizes the interaction and interdependence of all things with each other and with their environment. Points up the biological analogy between the forest and the sea.

Blake, Peter, GOD'S OWN JUNKYARD, Holt, 1964

Excellent illustrations and vigorous reading on the "Planned deterioration of America's landscape." Contrasting examples of deterioration and beauty in towns, along roads, in the sky, are introduced by brief essays, illustrated with numerous photographs and highlighted with quotations. Can be used in conjunction with discussions on almost any environmental problem. Text suitable for junior high, but illustrations useful in elementary school.

Ehrlich, Paul, THE POPULATION BOMB, Sierra Club, 1968

Calls for immediate action by the individual to halt the growth of population. Erlich describes the dimensions of the crisis in all its aspects and provides a realistic evaluation of the remaining options.

Farb, Peter and the editors of Life, ECOLOGY, Time, 1963

Excellent introduction to ecology covering all aspects of plant-animal-man relationships. Final chapter deals briefly with historic attitudes toward ecological concepts and current awareness of need for conservation measures. Many full-page illustrations throughout make this useful for browsing for all age groups. A map and descriptive notes of the major biomes of the world appear at the end of text. Also, a bibliography with classified entries. The other volumes in this Life Nature Library are a valuable addition to any classroom.

Leopold, Aldo, SAND COUNTY ALMANAC: WITH OTHER ESSAYS ON CONSERVATION FROM ROUND RIVER, Oxford University Press, 1966

Probably one of the most quoted books in the field on conservation. A collection of essays that points up the concept of a land ethic and the need for man to recognize his place in relation to the entire community of things organic and inorganic. His essay entitled "Odyssey" will give teachers and any student from junior high up an unforgettable understanding of the carbon cycle.

Lodge, James P., SMOAKE OF LONDON: TWO PROPHESIES, Maxwell Reprint Co., 1970

This is a reprint of two tracts inveighing against air pollution and calling for action to abate it - one published in 1661 and the other in the 1880's or '90's (exact date unclear). Intriguing possibilities for social studies.

Nash, Roderick, ed., THE AMERICAN ENVIRONMENT: READINGS IN THE HISTORY OF CONSERVATION, Addison-Wesley, 1968

A collection of readings illustrating the development of the American conservation movement in theory and practice. There is also a "Chronology of Events" which the teacher will find very useful. At the end of the text, a detailed selected bibliography covers important books, articles and unpublished theses.

Perry, John, OUR POLLUTED WORLD: CAN MAN SURVIVE? Watts, 1967

The origins, nature and disastrous effects of air and water pollution are examined in detail, as well as what is being done to alleviate the problems. This book offers a broad overview in an easily read style.

Shepard, Paul and Daniel McKinley, eds., THE SUBVERSIVE SCIENCE: ESSAYS TOWARD AN ECOLOGY OF MAN, Houghton Mifflin, 1968

A collection of searching and provocative essays on the ecology of man. "The central theme is that the well-being of mankind is inescapably associated with a healthy, productive and attractive environment." Introduces teachers to some of the authors currently writing on environmental problems.

Storer, John, WEB OF LIFE, New American Library, 1956

Explains in simple language and with great clarity the complex term, "Balance of Nature."

ENVIRONMENTAL EDUCATION BIBLIOGRAPHY

For Grades 10 through 14

"AIDS To Environmental Education" is a fitting title for this compilation because no one bibliography could hope to encompass the current torrent of materials pertaining to environmental education. The flood of books alone is growing to such proportions as to constitute a threat to the environment. Our objective is to alert students and teachers to some of the outstanding materials, and to provide references to sources of much more. Many fields are touched upon -- i.e. the sciences, humanities, social sciences -- to impress upon the reader the all-encompassing nature of environmental education.

In selecting the books for this list, emphasis was placed upon those that might not otherwise come to the teacher's attention and which would suggest different approaches to environmental education. Many of these books in turn contain excellent reading lists. Also the section on bibliographies herein will lead the teacher to the standard works on conservation, natural resources, and environmental problems.

This series of AIDS was compiled for the U. S. Office of Education by the librarian of the Hatheway School of Conservation Education, the education division of the Massachusetts Audubon Society. They represent a select, rather than comprehensive, listing of materials prepared for the information and convenience of teachers. Selection of material for these lists by either Massachusetts Audubon Society or the U. S. Office of Education does not constitute official endorsement or approval of it to the exclusion of others which may be suitable.

BIBLIOGRAPHIES

Moorachian, Rose, Ed., WHAT IS A CITY? Boston Public Library, 1969

A gold mine of information! Annotated bibliography on books, pamphlets, periodicals, films, filmstrips, loops, recordings and realia. Contemporary themes and issues. Grade level indicated.

Moore, John A., SCIENCE AND SOCIETY: A BIBLIOGRAPHY, 2nd ed. AAAS, 1971

A must for any high school library. Also an excellent resource for teachers. The first section offers general references to the subjects covered, including a list of anthologies. Second section lists books and articles.

National Science Teachers' Association, ENVIRONMENTAL EDUCATION FOR EVERYONE, NSTA, March 1970

A bibliography of curriculum materials for environmental studies. Materials were not evaluated by NSTA prior to publication. List is, however, a useful lead to much good material.

Naumer, Janet Noll, AMERICAN INDIANS: A BIBLIOGRAPHY OF SOURCES, American Libraries, October 1970

The request for materials on the American Indian is soaring. This bibliography is one good source. It includes periodicals and non-print materials.

Planned Parenthood - World Population, PAPERBACKS ON POPULATION FAMILY PLANNING, AND RELATED SUBJECTS, A SELECTED BIBLIOGRAPHY FAMILY PLANNING AND RELATED SUBJECTS

Briefly annotated bibliographies. These are among several put out by Planned Parenthood-World Population, one of the best sources of informative materials for population education.

Serina Press, GUIDE TO FILMS (16mm) ABOUT ECOLOGY, ADAPTATION AND POLLUTION

The guide provides brief descriptions of 16mm films available from 28 producers, distributors, and university audio-visual media centers. Obviously not complete, this booklet nonetheless is an excellent source.

Scholastic Teacher, October 1971, SURVIVAL GUIDE TO ENVIRONMENTAL EDUCATION,

Annotated multi-media bibliography.

Twelker, Paul A., BASIC REFERENCE SHELF ON SIMULATION AND GAMING. Series One Paper from ERIC at Stanford, June 1970.

A lead to books, bibliographies, professional organizations, centers of activity, journals and newsletters, in the field of simulation and gaming.

U. S. Department of Health, Education and Welfare, FREE FILMS ON AIR POLLUTION

Annotated bibliography of 16mm films available from USHEW.

U. S. Department of Housing and Urban Development, ENVIRONMENT AND THE COMMUNITY, U. S. HUD, April 1971

An annotated bibliography that covers books, reports and articles pertaining to problems of environmental degradation in American cities and settled communities. Bibliographies are listed at the end of each section to enable users to pursue their particular interests. Germane films, periodicals and organizations are included to provide supplementary sources of information or guidance. Valuable source for use with the high school geography project GEOGRAPHY IN AN URBAN AGE.

U. S. Department of the Interior, CONSERVATION AND ENVIRONMENT FILMS AND RELATED NATURAL RESOURCE FILM SUBJECTS

Briefly annotated list of 16mm color, sound films available from various branches of the Federal Government.

U. S. Department of the Interior, READINGS FOR THE ECO-ACTIVIST, USDI, 1970

An annotated bibliography of selected environmental publications of the executive branch of the Federal government.

BIBLIOGRAPHY OF POPULATION EDUCATION, Carolina Population Center, Chapel Hill, NC, October 1971

A listing of 115 items -- books, reports, journal articles, etc. Not annotated. This center is also a good source of curriculum materials.

CURRICULUM MATERIALS

AIR POLLUTION EXPERIMENTS for JUNIOR AND SENIOR HIGH SCHOOL SCIENCE CLASSES, Air Pollution Control Association

This manual of experiments is designed to acquaint students at both the junior and senior levels with some of the problems and effects of air pollution and some of the practical means of overcoming them. Experiments have been selected and designed to utilize equipment and instruments which most high schools would have in their chemistry, physics, or biology laboratories. Three other valuable sources:

AIR POLLUTION EXPERIMENTS HIGH SCHOOL EDITION, Cooperative Extension Service, Rutgers University.
SCIENTIFIC EXPERIMENTS IN ENVIRONMENTAL POLLUTION, E. C. Weaver, ed., Holt, 1968.
EXPERIMENTS FOR THE SCIENCE CLASSROOM BASED ON AIR POLLUTION PROBLEMS, State of California, Department of Public Health.

American Association for the Advancement of Science, CATALOGUE OF TAPES OF SELECTED SESSIONS 1968 and 1969, Meetings AAAS

The tapes are selected for their current relevance and importance." In the absence of any censorship or content editing, the listener should not be surprised to hear the calm presentation of an experienced scientist followed by a heated exchange with a young activist." Available as reels or as cassettes.

AMERICAN EDUCATION PUBLICATIONS

Well-illustrated, inexpensive units, good for easy-to-read introductory material.

Our Polluted World by AEP staff writers, 1968. Helps students understand the scientific principles involved in both the causes and effects of pollution. Shows how this knowledge can be applied to overcome this national problem.

The Conservation Story by George Pollock, 1969. An historical overview of great conservation battles in U. S. History. Through case studies, it probes today's most urgent conservation questions: the fight over DDT, the redwoods issue, air and water pollution, and strip mining.

Ecology: Man Explores Life by Jacqueline L. Harris and Erwin A. Steinkamp, 1970. A study of ecology through case studies of scientists at work. As readers absorb ecological concepts, they also acquire a knowledge of scientific problem-sharing techniques.

B. S. C. S. HIGH SCHOOL BIOLOGY, Green Version 2nd ed., Rand McNally, 1963

The "Green Version" approach to biology is an ecological one. The main difference between this and earlier efforts is the interdisciplinary treatment and the investigative nature of the approach. Objectives are stated in the ESCP Teacher Guide and ESCP Newsletters. Specific subjects: astronomy, meteorology, geology, oceanography, geography, environmental studies. Grade level: grades 8-10 depending on ability level of students, can be used with low ability students if investigations are the primary classroom activity. Textbook primarily designed for average and above-average students in the 13-15 age bracket.

The ESCP pamphlet series is a most valuable, well-illustrated source of information, activities and references. These can be used independently of the text.

The ESCP Pamphlets available to date are:

1. Field Guide to Weathering
2. Field Guide to Soils
3. Field Guide to Layered Rocks
4. Field Guide to Fossils
5. Field Guide to Plutonic and Metamorphic Rocks
6. Field Guide to Beaches
7. Field Guide to Lakes
8. Field Guide to Astronomy Without a Telescope
9. Field Guide to Color of Minerals
10. Field Guide to Meteorites

EXTINCTION, Sinauer Associates, 1970

This is a board game for two to four players. The game deals with some of the key processes by which species survive and evolve, or become extinct: reproduction, migration, mortality, competition, predation, and genetic change. It also illustrates the complex and sometimes devastating chain reactions which may be started by changes in the environment, particularly those caused by man. Teachers may request the excellent teacher's guide. There are many possibilities for adaptations and variations to fit the teacher's particular purposes.

FAMILY PLANNING, POPULATION PROBLEMS AND THE SECONDARY SCHOOL CURRICULUM, Planned Parenthood-World Population

This booklet contains brief statements by six educators and population specialists on the need for curriculum revision, ways of incorporating the topic of population into the existing courses, and strategies for arousing school interest in the population crisis. Included is a bibliography of selected books, pamphlets, and films on population and family planning.

Milliken, Margaret, et al., FIELD STUDY MANUAL FOR OUTDOOR LEARNING, Burgess, 1968

A manual of activities for studying natural resources. The first section deals with mapping the field study area. The following sections detail activities in the study of soil, water, plants, animal life and weather. Another useful manual, with some keys not found elsewhere, is GAME BIOLOGY AND GAME MANAGEMENT, by H. H. Stains, Burgess, 1962.

Henderson, Martha T., ENVIRONMENTAL EDUCATION: SOCIAL STUDIES SOURCES AND APPROACHES, Oct. 1970, ERIC Clearinghouse for Education and Social Science

A sampling of programs that social studies teachers will find provocative. Detailed comments on projects for elementary and secondary levels followed by a bibliography.

HIGH SCHOOL GEOGRAPHY PROJECT, Association of American Geographers.

A year-long course made up of six units with complete teaching materials, student resources, workbooks, teacher's guides, filmstrips, phonograph records, transparencies, maps, air photos, games.

In particular teachers interested in environmental subject matter will want to consult the "Habitat and Resources" unit and selected activities in the "Geography of Cities" and "Manufacturing and Agriculture" units.

FROM GEOGRAPHIC DISCIPLINE TO INQUIRING STUDENT is the final report on the High School Geography Project. This covers the work of the project since its inception in 1961. The appendices are particularly valuable for an overview of the project content.

THE LOCAL COMMUNITY: A HANDBOOK FOR TEACHERS, Macmillan, 1971. This handbook is a reference and guidebook for teachers that includes many teaching and learning suggestions using the local area as the prime resource.

The handbook has four sections: 1) Relating geographic concepts to the local community; 2) Preparing to teach about the local community; 3) Classroom activities, and 4) Selected bibliography. Included are a series of 13 inquiry-oriented activities about the local community and almost all are examples from actual local areas.

HOW TO USE LOCAL HISTORY, a pamphlet from N. E. A., would be a useful addition.

Another interesting pamphlet, ENVIRONMENTAL GEOLOGY IN TOWN AND COUNTRY by W. C. Hayes and J. D. Vineyard, opens up a rapidly expanding facet of geology that could be used in conjunction with H. S. G. P. It is available from Missouri Geological Survey and Water Resources, Rolla, MO.

1973 NATIONAL E. Q INDEX, National Wildlife Federation

Reprinted from April-May 1973 National Wildlife Magazine. Report on how our environmental quality is deteriorating at an accelerating rate. Includes EQ index of Air, Water, Soil, Timber, Minerals, Wildlife and Living Space. One reprint may be obtained free from NWF.

A bibliography is also available giving the references on which the statistics in the EQ Index are based.

OUR MAN-MADE ENVIRONMENT - BOOK SEVEN, Group for Environmental Education (GEE).

A most unusual and exciting text-workbook that is an introduction to the study of the man-made Environment. Although developed for grades 7-9 this program has many stimulating ideas for high school students and teachers. It poses four basic questions: 1) What is the man-made environment? 2) Why do we build our environment? 3) What determines the form of our environment? 4) How do we change our man-made environment?

Several different kinds of problems are proposed for students to work through, some by discussion and some by constructing various forms and buildings included in punch-out form. The book emphasizes that there are no right or wrong answers, only choices for the student to make depending upon the way he sees his world or wants it to be.

The basic ideas and techniques of this program can be expanded as the high school student studies urban areas using the HIGH SCHOOL GEOGRAPHY PROJECT or becomes involved in community projects such as DOING GERMANTOWN. (This and HSGP are annotated in this section.) The art student will also find this book stimulating.

GEE has other programs underway that will soon be in print.

The spring issue of Design Quarterly, published by the Walker Art Center, Minneapolis, MN is entitled Making the City Observable. It is a rich source of ideas on urban environmental education.

A different aspect of design, explored in Sommer Personal Space (cited in the Book section) can be introduced as students expand their study of the Man-Made Environment.

PEOPLE AND THEIR ENVIRONMENT: TEACHER'S GUIDES TO CONSERVATION EDUCATION, Brennan, Matthew J., ed., Ferguson

A 1-12 curriculum. Each guide contains individual lessons, lists of instructional materials and a bibliography. The following guides provide some useful ideas for senior high school teachers: Social Studies, Grades 10-12, Home Economics, Biology and Outdoor Laboratory.

POPULATION PROBLEMS AND THE SECONDARY SCHOOL CURRICULUM, Planned Parenthood, World Population

This booklet contains brief statements by six educators and population specialists on the need for curriculum revision, ways of incorporating the topic of population into the existing courses and strategies for arousing school interest in the population crisis. Included is a bibliography of selected books, pamphlets, and films on population and family planning.

POPULATION CURRICULUM STUDY, K-12, University of Delaware, 1971

Materials were out-of-stock when ordered for review for this bibliography. The following comments are quoted from a variety of reliable sources. "An elegant conceptual scheme based on the belief that man is a part of a natural system, the Earth, and is ultimately subject to the limits of the system." "Accompanied by the most complete bibliography of books, periodicals, and films seen to date." "Concepts are to be infused throughout the K-12 curricula, rather than delivered all at once. Appropriate sub-concepts are recommended for three grade clusters (K-4, 5-8, 9-12), although they needn't be followed strictly." "The curriculum is broadly based and includes many perspectives on population." Materials will soon again be available.

POPULATION BULLETIN; WORLD POPULATION DATA SHEETS; POPULATION PROFILES Population Reference Bureau

P. R. B. is the best source of information on facts about size, composition and dynamics of the world's population and analyses of the impact of these demographic facts on the quality of human life throughout the world. Membership is only $5 for teachers, and all members receive all regular P. R. B. publications.

PROGRAMS IN ENVIRONMENTAL EDUCATION, National Science Teachers Association

Describes more than 50 programs in schools around the country. Programs include all formats and grade levels. Only programs now underway and able to distribute materials and/or information have been included.

RESOURCE UNIT ON POPULATION PRESSURE, Baltimore City Public Schools, Bureau of Publications, Baltimore

A Teacher's Guide for the teachers of the Baltimore Public Schools at all levels. The pamphlet attempts to alert teachers to population pressure at local to international levels. Background information is presented, suggested approaches given, and a bibliography of instructional materials is included.

Roloff, Joan G. and Robert C. Wylder, THERE IS NO "AWAY": READINGS AND LANGUAGE ACTIVITIES IN ECOLOGY, Glencoe Press, 1971

This book has two stated purposes -- (1) to make the student aware of the current environmental crises and (2) to help students learn to communicate better, especially by way of language. In this area of suggested communication activities the teacher will find many workable suggestions.

SCIENCE AND SOCIETY, Madison Public Schools, 1969

This syllabus is designed as a teacher guide for a one-semester seminar course. The course is an attempt to provide student opportunity to investigate the interrelationships between science and society. The course requires that each student identify a specific problem, research this problem and propose alternate solutions to the selected problem. This syllabus would be particularly useful to a beginning teacher. The course plan is outlined and general problem areas suggested. There is also a lengthy bibliography. This ties in well with SCIENCE, NATURE AND THE SURVIVAL OF MAN listed below. Madison Public Schools, 545 West Dayton St., Madison, WI.

SCIENCE, NATURE AND THE SURVIVAL OF MAN, Pennsylvania Department of Education

This is a course for secondary students not majoring in science, developed for grades 11 and 12. SNSM is not a tightly structured program identified with a particular science discipline. It is intended to foster the study of subjects identified as important by students and teachers reacting to their local circumstances.

The philosophy stated in the teacher's guide and the evaluating tool -- SNSM SCALE are well worth consideration.

SMAC/SCIENCE AND MATHEMATICS EDUCATION ANALYSIS CENTER. ERIC: HOW TO USE IT FOR ENVIRONMENTAL EDUCATION

Request this report from SMAC to obtain complete information on the retrieval of reports, curriculum guides, journal articles, etc. on environmental education. A complete listing of ERIC Clearinghouses is given. Write for Newsletters from those in your field.

SOCIAL EDUCATION, January 1971, Volume 35, No. 1, National Council for the Social Studies

This issue of the NCSS journal is entirely devoted to the Environmental Crisis and incorporates an interdisciplinary approach. Contributors include a conservationist, a biologist, an economist, a psychiatrist, a classroom teacher, an artist, a community leader and several senators. There is also a lengthy section on sources and resources and instructional media.

FILMS

This is a very brief listing of films. Here again, the possibilities are so numerous that it is beyond the scope of this bibliography to list them all. There are, however, several film bibliographies cited in the bibliography section, and references made under periodicals to those containing film reviews.

BEARGRASS CREEK, color, 19 minutes, Stuart-Finley Productions

This story of a stream is the story of many polluted waterways in our country. The road from clean water to polluted water is only a short distance in time and effort. It is much longer and more difficult to reverse the direction.

CONSERVATION AND BALANCE IN NATURE, color, 18 minutes, International Film Bureau

The word "ecology" has become almost a household term without most persons knowing what it means. The film relates, through easily understood examples taken directly from nature, what ecology is. It also examines man's role in effecting balances in biological communities.

THE HOUSE OF MAN -- OUR CHANGING ENVIRONMENT, Black and White, 17 minutes, Encyclopaedia Britannica

Tells how man has changed and spoiled his environment through the waste of natural resources and the pollution of air and water. Suggests ways of preserving the resources.

A MATTER OF TIME, color, 27 minutes, Conservation Foundation

Man first struggled to survive in a hostile environment. Now that he has survived, he is fast destroying the very environment upon which his life depends. Slow start, but otherwise very useful film.

A NATION OF SPOILERS, color, 11 minutes, Encyclopaedia Britannica

Our growing problem of vandalism and littering is a national disgrace. Each one of us can help correct this situation. This film gives the youngster some ideas on how this can be done.

THE POND AND THE CITY, color, 16 minutes, Encyclopaedia Britannica

Man is rapidly destroying his natural environment and there is an end to our natural resources. Is urbanization worth losing all our natural areas? Can anything be done about it?

POPULATION ECOLOGY, color, 19 minutes, McGraw-Hill

Populations of plants and animals including humans have natural limits that are set by the environment in which they live. There are many factors that affect population and their interactions are complex.

A STRAND BREAKS, color, 15 minutes, Encyclopaedia Britannica

The natural balance of the living community is usually maintained by the interrelationships of all its inhabitants. Man, however, through ignorance and self-interest, often upsets this balance and suffers the drastic results. Emphasizes that man must intelligently manage his environments.

THE STRAND GROWS, color, 15 minutes, Encyclopaedia Britannica

Each life -- plant or animal -- is like a tiny strand in a vast web that binds all living things together, each life having its effect upon other lives. Shows how some die out while others develop. Emphasizes importance of a balance in nature.

THE THIRD POLLUTION, color, 30 minutes, National Audio-Visual Center.

The ever-increasing problem of solid waste disposal is discussed along with related air and water pollution sources. Some of the new techniques of solid waste management are demonstrated.

TRAGEDY OF THE COMMONS, color, 26 minutes, King Screen Productions

This film on issues of population is a classroom version of Garrett Hardin's article of the same title in the December 13, 1968 issue of Science. Tragedy of the Commons draws an illustration from 18th century England where farmers shared the benefits of a mutual pasture for their animals. Profit motive competed with limited space, and the commons failed. The film goes on to develop the analogy between the destruction of the commons and our current dilemma of rapidly diminishing resources, overcrowding, and stress on a finite earth.

WATER AND LIFE, color, 15 minutes, Bailey Film Associates

Water is important to all living things. Its physical characteristics make it the ideal medium for transport of food and waste products between cells. Describes evolutionary changes as plants and animals left the water to live on land.

FILM-LOOPS

These are single concept films in a convenient cartridge. There is no sound track, thereby making it possible to adapt them to each teacher's needs. They cover a wide variety of subjects and are particularly useful for independent study.

Ealing Film-Loops is one of the leading producers. Among their titles are the following: ADAPTATION TO ENVIRONMENT, MARINE BIOLOGY, KILLING WEEDS WITH 2,4-D and THE CHANGING CITY.

B. S. C. S. (see Curriculum Materials section) has produced several excellent film-loops.

Catalogs from instructional materials producers will list others.

FILMSTRIPS

AIR POLLUTION AND YOU, color, 47 frames, silent, Current Affairs Films

An up-to-date presentation on how, what, and where air pollution is and how it affects all of us. Photography, graphs and current facts add to this film's usefulness. The questions and ideas for further investigation are very good.

AMERICA'S URBAN CRISIS, sound, color, Society for Visual Education

Series titles: THE ROOTS OF OUR URBAN PROBLEMS, THE AIR POLLUTION MENACE, WATER POLLUTION -- A COMPLEX PROBLEM, SOLID WASTE, A NEW POLLUTANT, THE TRANSPORTATION CRISIS, THE HOUSING CRISIS.

On-site photography in six major U. S. cities. Students examine urban dilemmas where industrial and technological achievements and personal irresponsibility have created by-products that menace the quality of urban life. Problem-oriented segments at the end of each filmstrip stimulate discussion.

CRISIS OF THE ENVIRONMENT, sound, color, New York Times, Book and Educational Division

Series titles: MAN, AN ENDANGERED SPECIES? BREAKING THE BIOLOGICAL STRAND, VANISHING SPECIES, PRESERVE AND PROTECT, and THE POPULATION EXPLOSION

A technically superior package of color filmstrips, recordings and teacher's text presents an objective, scholarly and ecologically sound treatment of five aspects of the crisis. It places heavy stress upon the role of values in the generation of public issues.

ECOLOGY, 52 frames, silent, color, McGraw-Hill

Series Titles: PHYSICAL ENVIRONMENT, ECOLOGICAL SUCCESSION, THE FOREST AS A COMMUNITY, THE FIELD AS A COMMUNITY, THE POND AS A COMMUNITY.

A variety of presentations on ecological communities with their plant and animal relationships. Many definitions. Develops succession and many basic concepts. Good questions and activities suggested. Can be adapted for use at lower grade level.

ECOLOGY AND MAN -- Set I, 50 frames, silent, color, McGraw-Hill

Series Titles: INTRODUCTION TO ECOLOGY, CHANGES IN ECO-SYSTEMS, ENERGY RELATIONSHIPS, HABITATS AND NICHES, POPULATIONS AND BIOMES, ADAPTATIONS TO ENVIRONMENT.

This series introduces basic ecological principles and vocabulary and each film develops in sequence a major concept. Excellent color, good questions for discussion. They may be adapted for use according to ability. Supplementary information and explanation by user is necessary.

ECOLOGY AND MAN -- Set II, 50 frames, silent, color, McGraw-Hill

Series titles: THE FOREST BIOME - PART I AND PART II, THE GRASSLAND BIOME, THE DESERT BIOME, FRESHWATER ECOLOGY, SEACOAST ECOLOGY.

This series shows how the basic ecological principles operate in the major biomes and habitats. Prior knowledge of concepts and terminology is necessary for use of these filmstrips. The color is excellent, good discussion material adaptable according to ability.

ECOLOGY AND MAN -- Set III, 50 frames, silent, color, McGraw-Hill

Series titles: MAN-MANAGED ECOSYSTEMS, THE MANAGEMENT OF WATER, THE MANAGEMENT OF SOIL, THE ECOLOGY OF FARMING, COMPETITIVE LAND USES, HUMAN ECOLOGY.

Presented in this series are man's successes and failures in managing nature for his own benefit, and problems presented by the failures. Users should be familiar with basic ecological principles and terminology. Manual has good discussion questions and suggestions for activities and further reading.

ENVIRONMENT: CHANGING MAN'S VALUES, color, sound, Guidance Associates

Part I explores the individual's relationship to environmental issues; as part of the problem and the solution. Part II discusses the possible role of government and private institutions in combatting environmental decay. The series stresses that individual values and activities must be changed to improve the quality of life. Detailed teacher's guide.

ENVIRONMENTAL POLLUTION - OUR WORLD IN CRISIS, 64 frames, silent, color, Ward's

Series titles: NATURE OF THE CRISIS, ATMOSPHERIC POLLUTION, LAND POLLUTION, FRESHWATER POLLUTION, MARINE POLLUTION, POLLUTION CONTROL.

Content of filmstrips covers subject well. Very informative, good questions should lead to discussion. Introduces references for further study. Environmental vocabulary is introduced. Some of the concepts will require additional study. Very good accompanying manual.

MAN'S NATURAL ENVIRONMENT: CRISIS THROUGH ABUSE, sound, color, Guidance Associates

Part I demonstrates through such examples as the death of Lake Erie or the Santa Barbara oil spill, the catastrophic dangers of environmental pollution. Part II outlines ways to avoid the destruction of our environment. Detailed teacher's guide.

MODERN BIOLOGY: ENVIRONMENT AND SURVIVAL, sound, color, Society for Visual Education

Series titles: Group 2 - LIFE IN A SAND DUNE, SUCCESSION, LIFE IN A BOG, LIFE IN AN ALPINE ENVIRONMENT, LIFE IN A FALLEN LOG MICRO-COMMUNITY.

Explains animal-environmental interdependence, plant-animal communities, importance of biotic and abiotic conditions. This group is of particular value because of the unusual communities which it includes.

THE PEOPLE PROBLEM, sound, color, Guidance Associates

Part I defines the scope of the world population explosion and outlines its consequences. Part II describes measures now underway to control the population explosion. Students see efforts to develop fish-based foods and miracle grain crops and consider the work of the U. N. in this area. Detailed teacher's manual.

SQUANDERED RESOURCES, sound, black and white, New York Times, Book and Educational Division

This filmstrip presents a historical summary of the use and misuse of resource needs and resource potentials. The sound filmstrip provides appropriate breaks for discussion and the manual offers helpful background reading and bibliography. However, the 71-frame presentation is lengthy and contains much information. It should probably be divided for use in two successive classroom sessions.

TOPICS IN ECOLOGY, sound, color, Multi-Media Productions

Series titles: WHAT IS ECOLOGY, WHAT IS POLLUTION, WHAT IS AIR POLLUTION, THE AUTOMOBILE, BEYOND POLLUTION, PROSPERITY=POLLUTION.

This series gets at man's attitudes and value -- priorities which have caused today's ecological disasters. The excellent, contemporary photography is realistic and the narration poses many questions for class discussions.

THE WISDOM OF WILDNESS, sound, color, Guidance Associates

As a technological pioneer... and a naturalist-conservationist, Charles Lindbergh offers students unique insights into questions raised by the conflict between technological expansion and the drive to preserve natural lands. Detailed teacher's manual.

GRAPHICS

CONSERVATION POSTER SET, J. Weston Walch, publisher

Each poster carries a large illustration and a thought-provoking commentary. Posters in each set are coordinated to give a survey of the area under study. 18 posters per set, 11" x 14". The sets include such titles as Ecology of the City, Conservation of Wildlife, Air Pollution.

HENRY GIBSON ECOLOGY POSTERS, Synergisms

Six colorful 2' x 3' posters that will delight Henry Gibson admirers. Also put across a worthwhile message on eco-pollution. Students will have suggestions for many other posters.

HOW MAN POLLUTES HIS WORLD, National Geographic, Dec. 1970

Colorful painting 42 1/2"x 29 1/2", depicts many sources of manmade pollution.

LIFE EDUCATION REPRINTS ON THE ENVIRONMENT, Life Education Program

A vivid visual survey of the declining environment is available in this series of reprints. The reprints assess the "environmental damage" to air, water, and wildlife and directly or indirectly to man himself. Most are easy to read and all contain numerous large full-color photos of the conditions described. Especially recommended are ENVIRONMENT: WHAT CAN BE DONE?, WATER POLLUTION -- THE BLIGHTED GREAT LAKES and AIR POLLUTION.

STUDY PRINTS, Society for Visual Education

These are 13" x 13" colored prints on heavy stock. The set entitled GEOGRAPHY FROM SPACE is most interesting and would be useful in any secondary course in Earth Science or Astronomy. The NASA publication ECOLOGICAL SURVEYS FROM SPACE also fits in well here.

BOOKS

Those books dealing with the techniques and theories of education are marked with a T following the annotation. It is assumed that the rest of the books are valuable to both students and teachers.

Allen, Marjorie, PLANNING FOR PLAY, MIT Press, 1969

Exciting alternatives in playground design. Offering the variety, adventure and fantasy opportunities of play in the countryside to city children, looked after by teenage playleaders. This is an area in which high school students could be very effective. See also Seymour SMALL URBAN SPACES cited later in this list.

American Universities Field staff, THE IMPACT OF POPULATION PROBLEMS ON SOCIETY, AUF, 1971

These 10 booklets go beyond demographic concern with populations size, density, distribution, and vital statistics to examine the social concomitants of population trends, the interplay between attitudes and a variety of institutional arrangements which accompany population changes. Problems are considered in the Philippines, Yugoslavia, Malawi, Brazil, Japan, Bolivia, Singapore, Afghanistan, and Kenya. A teacher's guide is also available which discusses the relationship between the data presented in each title and their significance to the over-all theme of the series.

Amos, William H., THE LIFE OF THE SEASHORE, McGraw-Hill, 1966

This is one volume in the series OUR LIVING WORLD OF NATURE. Each book deals with an American biome, such as the forest, the seashore, or the desert, and leads the reader to an understanding of interrelationships within the biome. Written in an easy-to-follow lively style. The illustrations, charts and diagrams aid greatly in making this a most useful reference set. In the appendix of each of these books you will find a glossary, a bibliography, guides to identification, and ideas for science activities. A teacher's guide is available.

Andrewartha, H. G., INTRODUCTION TO THE STUDY OF ANIMAL POPULATIONS, University of Chicago Press, 1961.

An advanced compact text on the theory and the practice (lab and field experiments) of animal population studies. Many good ideas for approaching population studies.

Further reading: Allee, W. C., PRINCIPLES OF ANIMAL ECOLOGY, Saunders, 1949. Section on "Population Factors and Selected Population Problems." A good source for creating case studies and lab and field investigations.

Slobodkin, L. B., GROWTH AND REGULATION OF ANIMAL POPULATIONS.

Barr, Robert D., ed., VALUES AND YOUTH, (Crisis Series No. 2) National Council for the Social Studies, 1971.

"Kaleidoscopic View of the Moods, Mods, and Meanings of Youth Activities in Contemporary America." Specific teaching strategies that will help every teacher are outlined. (T)

Bates, Marston, THE FOREST AND THE SEA: A LOOK AT THE ECONOMY OF NATURE AND THE ECOLOGY OF MAN, Random, 1960.

Emphasizes the interaction and interdependence of all things with each other and with their environment. Points up the biological analogy between the forest and the sea.

Blake, Peter, GOD'S OWN JUNKYARD, Holt, 1964.

Excellent illustrations and vigorous reading on the "Planned deterioration of America's landscape." Contrasting examples of deterioration and beauty in towns, along roads, in the sky, are introduced by brief essays, illustrated with numerous photographs and highlighted with quotations. Can be used in conjunction with discussions on almost any environmental problem. Excellent suggestions for local projects depicting pollution will be found in IMPROVE YOUR ENVIRONMENT listed in Curriculum Materials section.

Brainerd, John W., NATURE STUDY FOR CONSERVATION: A HANDBOOK FOR ENVIRONMENTAL EDUCATION, Macmillan, 1971

A well-organized text that provides basic concepts and approaches to biological studies in outdoor settings. Three parts cover (1) concepts (2) techniques, observing natural resources, recording data, collecting and experimenting (3) responsibilities, protecting the land, and use of campus and schoolgrounds. A bibliography arranged by chapters provides a wealth of additional sources. Teachers will find it a useful resource at all levels.

Browning, T. O., ANIMAL POPULATIONS, Harper & Row Publishers, Inc., 1963.

A brief introduction to animal population study dealing with experimentally tested concepts. The emphasis is on how the environment influences populations and maintains a balance of populations in the living community. See also Andrewartha in this section.

Buchsbaum, Ralph and Mildred, BASIC ECOLOGY, Boxwood, 1957

As the title indicates, a basic introduction to ecology for beginners in the field. Useful bibliography that includes journals and textbooks as well as titles under special aspects of ecology.

Cairns, John, POPULATION DYNAMICS, Rand McNally & Co., 1966

An excellent book in the PATTERNS OF LIFE Series written in a clear style and with a fine selection of graphs, charts and photos.

Carey, George W. and Julie Schwartzberg, TEACHING POPULATION GEOGRAPHY: AN INTERDISCIPLINARY ECOLOGICAL APPROACH, Teachers College Press, 1969

The authors use the case method to explore systematically the relationship between the carrying capacities of particular environments and the populations they support and to show how changes in population are affected, by changes in other variables: environment, technology, social organization and ideology. An annotated bibliography of more than 300 entries includes some to theoretical works. Visual aids are reviewed and techniques for their interpretation and construction are included. See HIGH SCHOOL GEOGRAPHY PROJECT annotated in Curriculum Materials Section. (T)

Christensen, J. A., HONEST INJUN MEDIA AND METHODS, October 1971, Vol. 8, No. 3

The unfortunate title of this article should not prevent the reader from looking it up because it is an excellent source of material on the American Indian. As more and more people come to see the merits and beauty of Indian philosophy in regard to nature, teachers should be prepared to use literature by and about the Indian. See also La Farge LAUGHING BOY cited later in this list.

Congressional Hearings, Miscellaneous. House Committee on the Merchant Marine and Fisheries, HEARINGS ON THE HUDSON RIVER EXPRESSWAY. EFFECTS ON FISH AND WILDLIFE

Senate Committee on Interior and Insular Affairs, HEARINGS ON THE EVERGLADES NATIONAL PARK.

Congressional committee hearing transcripts are distributed free of charge to the public. They may be obtained by writing to the appropriate committee.

At a congressional hearing, proponents of diverse public viewpoints have their day in court.

The Hudson River and Everglades hearings are outstanding both for the liveliness of the debate, and the landmark decisions in conservation history which they pertain to. Both are excellent sources for teaching students about politics, environmental ethics, and how to present highly technical information to a group of non-specialist and often cantankerous people who probably don't support your view.

The bi-weekly CONSERVATION REPORT, distributed free of charge by the National Wildlife Federation (see listing under NWF in this index) will alert the reader to other hearings on the environment.

Cook, Robert and Jane Lecht, PEOPLE, Population Reference Bureau, 1970

This booklet describes how and why world population is growing rapidly and the effects on industrial nations as well as "the other two-thirds" of world's people and some means of coping with the problem. Its graphs, vocabulary, style, and general format will appeal to those high school pupils with limited reading ability.

Cooley, Richard A. and Geoffrey Wandesforde Smith, eds., CONGRESS AND THE ENVIRONMENT, University of Washington, 1970.

CONGRESS AND THE ENVIRONMENT is the result of a graduate seminar at the University of Washington on the special impact of government decisions and laws on various regional and national environmental quality problems. Each chapter is concerned with a piece of congressional legislation and analyzes its effectiveness in dealing with an environmental problem. The case studies should provide useful materials for teachers preparing environmental quality units at various levels.

Council on Environmental Quality (C. E. Q.), 102 MONITOR, 722 Jackson Place, N. W., Washington, D. C. 20006

C. E. Q. briefly describes and tells where to send for free copies of the latest impact statements. (Also called "102" statements.) "102" statements are, for the most part, nontechnical and highly readable. Statements are routinely prepared for small local roads, dams, and bridges as well as for larger developments like nuclear power plants, the Alaskan pipeline and the oil drilling works in the Gulf of Mexico.

Students may wish to critically review "102" statements submitted for nearby developments they have studied in class. Whether they want to receive a practical political education, or learn to write better laws, the 102 MONITOR and the statements will prove useful to high school students and teachers.

Court decisions, miscellaneous.

"Environmental Defense Fund, Inc. vs. Army Corps of Engineers et al." (D.C., D.C. No. 2655-69) Action to bar construction of a cross Florida barge canal.

"Scenic Hudson Preservation Conference vs. F. P. C." (354 F 2d CA 2 1965) cert. denied, 384 E.S. 941 (1966).

These and other court decisions provide insight into the final consequences of environmental laws. Some laws are interpreted by the courts to be stronger than Congress probably intended them to be; other acts of Congress lose out in the courts. Students may learn how to write laws with fewer loopholes, laws which truly protect the environment, by examining appropriate judicial decisions.

Decisions for all cases which reach a court of appeals are printed in regional "reporters," available in any law library. Any of the nation's seven environmental law reviews will keep the reader abreast of vital forthcoming decisions.

Darling, F. Fraser and John P. Milton, eds., FUTURE ENVIRONMENTS OF NORTH AMERICA, Natural History Press, 1966

With the exception of several essays the reader may wish to bypass, this volume has several valuable characteristics not to be found in other anthologies (e.g. Ewald, Nash and Thomas) with which it should be used.

A strong series of articles on economics (by Boulding, Fisher, et al.), includes a thoughtful article by Marion Clawson on the economics and environmental impacts of increasing leisure activity.

Other unique articles are those on the restoration of lost and degraded habitats, and on the perpetuation of cultural patrimony into urban planning.

Davies, Delwyn, FRESH WATER, Natural History Press, 1969.

Description of the special chemical and physical properties that account for water's dominant position in the living world and the relevance of these properties to man's own physiological processes. Excellent illustrations. This offers a global view as do the other volumes in the NATURE AND SCIENCE LIBRARY.

Davies, J. Clarence III., THE POLITICS OF POLLUTION, Pegasus, 1970.

An elementary, instructive and readable account of pollution control from the viewpoint of a political scientist. Would fit in well with work students do, using the Tilton Water Pollution Project A CURRICULUM ACTIVITIES GUIDE TO WATER POLLUTION AND ENVIRONMENTAL STUDIES. (See Curriculum Materials section.) Students would receive a good introduction to the politics of water pollution control as well as to water conservation and management problems by reading the following:

Carhart, Arthur, WATER OR YOUR LIFE, Lippincott, 1959
Carr, Donald E., DEATH OF THE SWEET WATERS, Norton, 1966
Marine, Gene, AMERICA THE RAPED: The Engineering Mentality and the Devastation of a Continent, Simon & Shuster, 1968
Peterson, Elmer T., BIG DAM FOOLISHNESS, Devin Adair, 1954.
League of Women Voters Education Fund, THE BIG WATER FIGHT, Stephen Greene Press, 1966.

DeBell, Garrett, ed., ENVIRONMENTAL HANDBOOK, Ballantine, 1970.

About four-fifths of the Handbook deals with the "Meaning of Ecology" and consists of 31 readings that "explore the nature of some of the causes and some of the possible solutions to the major problems in the environmental crisis." The remaining portion has two short sections "Eco-Tactics: Individual Action" and "Eco-Tactics: Political Actions." Good list of films and a bibliography.

Teachers will find the handbook useful for supplementary reading, for generating class discussion, or for arousing interest in individual or group reports on specific environmental problems. Ballantine Books has published THE VOTER'S GUIDE TO ENVIRONMENTAL POLITICS by DeBell and THE USER'S GUIDE TO THE PROTECTION OF THE ENVIRONMENT by Swatek. These enlarge upon the similar sections in the Handbook. Another book along the same lines is Eco-Tactics -- The Sierra Club Handbook for Environmental Activists published by Pocket Books.

Disch, Robert, THE ECOLOGICAL CONSCIENCE: VALUES FOR SURVIVAL, Prentice-Hall, 1970

A well-chosen anthology that considers the scientific, sociological and political aspects of our present ecological values. To be read in conjunction with Metcalf, VALUES EDUCATION.

Duffy, Eric, CONSERVATION OF NATURE, McGraw-Hill, 1971

CONSERVATION OF NATURE brings to young people an awareness and understanding of current problems in the preservation of the fitness of our natural resources. Nature is here thought of in the broadest sense, encompassing all living things, as well as land, sea, air, water and even the modification of landscapes effected by man over centuries of settlement and agricultural use. Excellent photographs from international sources serve to indicate vividly the global aspects of the concern for the preservation of our natural resources.

Further reading:
J. A. Lauwery's MAN'S IMPACT ON NATURE, Natural History Press, 1970;
W. M. S. Russell, MAN, NATURE AND HISTORY, Natural History Press, 1969.

Ehrlich, Paul R. and Anne H., POPULATION, RESOURCES, ENVIRONMENT: ISSUES IN HUMAN ECOLOGY, Freeman, 1970

Comprehensive analysis, taken from a broad ecological approach, of worldwide population growth with resulting demands on food and other resources. The bibliographies at the end of each chapter add greatly to the value of this reference. A Teacher's Guide is also available upon request from W. H. Freeman Company.

Elder, Frederick, CRISIS IN EDEN, Abingdon, 1970

The Christian-Judaic tradition has often been accused of supplying moral absolution and praise to environmental destroyers. In the light of these accusations, the author, a young Christian theologian examines the question, "Can a person be a good Christian and a good environmentalist?" He draws skillfully from the writings of Christian theologians, paleontologists, biologists and other scholars to argue, "Yes."

Further reading:
F/M/N Papers --
    #1 -- CHRISTIANS AND THE GOOD EARTH, 1963
    #2 -- A NEW ETHIC FOR A NEW EARTH, Friendship Press, 1971
    Hamilton, Michael, THIS LITTLE PLANET (annotated on this list)
    Kuhns, William, ENVIRONMENTAL MAN, Harper, 1969

ENVIRONMENTAL WORKBOOKS, Scientists' Institute for Public Information

Clear, explicit, and authoritative, each one outlines and discusses a basic problem of the environment; airs alternatives and solutions; gives examples of citizen action taken; offers further resources in a selected bibliography. Titles: AIR POLLUTION, WATER POLLUTION, HUNGER, ENVIRONMENTAL EFFECTS OF WEAPONS TECHNOLOGY, ENVIRONMENTAL COST OF ELECTRIC POWER, NUCLEAR EXPLOSIVES IN PEACETIME and PESTICIDES.

Ewald, William R. Jr., ed., ENVIRONMENT AND CHANGE: THE NEXT FIFTY YEARS; ENVIRONMENT AND POLICY: THE NEXT FIFTY YEARS, Indiana University Press, Bloomington, 1968

Two of the most imaginative environmental anthologies. Papers in the "Change" volume attempt to formulate policies for coping with inevitable technological changes that will affect the physical environment. The "Policy" volume offers dialogue on recommendations to implement the philosophies and concepts expressed in the other volume.

Fabun, Don, DIMENSIONS OF CHANGE, Glencoe Press, 1971

DIMENSIONS OF CHANGE describes a collision course between what we are and what we could be. The time span is the next 30 years.

Quotations, illustrations, ideas, the entire format set this book apart. Even the most jaded of readers will find something to spark him.

An earlier book by Don Fabun, DYNAMICS OF CHANGE, Prentice-Hall, 1967, is equally intriguing. Both books have an air of science fiction that would tie in well with a unit on that subject.

Farb, Peter and the editors of Life, ECOLOGY, Time, 1963

Excellent introduction to ecology covering all aspects of plant-animal-man relationships. Final chapter deals briefly with historic attitudes toward ecological concepts and current awareness of need for conservation measures. Many full-page illustrations throughout make this useful for browsing for all age groups. A map and descriptive notes of the major biomes of the world appear at the end of text. Also a bibliography with classified entries. The other volumes in this Life Nature Library are a valuable addition to any classroom.

Ferguson editorial staff, CAREER OPPORTUNITIES: ECOLOGY, CONSERVATION, AND ENVIRONMENTAL CAREERS, J. G. Ferguson, 1971

This is a survey of 2-year, post-high school programs related to ecology. Possibilities here for high school work-study programs. As students are studying environmental problems in the classroom, they should be alerted to the careers open to them in these problem areas.

Further reading: Fanning, OPPORTUNITIES IN ENVIRONMENTAL CAREERS. Paradis, RECLAIMING THE EARTH: JOBS THAT HELP IMPROVE THE ENVIRONMENT. Munzer, PLANNING OUR TOWN (cited further on).

Foreign Policy Association, Inc., HEADLINE SERIES -- THE POPULATION EXPLOSION, No. 120, 1956

Many interesting ideas in this overview are clearly expressed in graphs, charts and maps. Discussion questions in eight areas are presented and references included.

No. 174, 1965, WORLD POPULATION PROBLEMS. A very helpful overview by Dr. Philip Hauser, Director of Population Research and Training Center at the University of Chicago. Discussion questions and reading references are included.

No. 206, 1971, POPULATION. A global view of the population problem written by a sociologist, Valerie K. Oppenheimer. Opportunity here for comparison with earlier Headline and Intercom series, and discussion of present trends.

Foreign Policy Association, Inc., INTERCOM, Vol. 6, No. 1, 1964. FOCUS ON WORLD POPULATION

A very helpful review of the work of the U. S. Government, the U. N. and volunteer organizations. Maps and charts of the world population are included as well as reports of university programs of research, a bibliography, and a film list.

Vol. 10, No. 4, 1968. THE WORLD POPULATION CRISIS: WHAT IT IS AND WHERE TO GET INFORMATION ABOUT IT. A review of the world population crisis featuring "Population Forecast: The Year 2018," "Memo to Teachers," "Charts for Classroom Use," "Where to Get Information About U. S., U. N., and Citizen Programs and Policies in Population," and "Films and Additional Readings."

Glacken, Clarence, TRACES ON THE RHODIAN SHORE: NATURE AND CULTURE IN WESTERN THOUGHT FROM ANCIENT TIMES TO THE END OF THE 18th CENTURY, University of California Press, 1967

The author makes the point that today's society is not the first to fundamentally alter its habitation. The records, biophysical and written, indicate that prehistoric and historic man were as deeply involved. And since Greece's Golden Age, writers, scientists and philosophers have vehemently disputed the extent of man's prerogatives and the goodness of his works in nature.

Glacken's coverage of the historical antecedents of present day views on nature, and man's proper place in it, is complete, scholarly and delightful reading.

Goldstein, Jerome, HOW TO MANAGE YOUR COMPANY ECOLOGICALLY, Rodale, 1971

In this brief paperback, Goldstein suggests concretely how corporations can be clean and profitable. His examples of corporate actions which are already underway are varied and encouraging. Students and teachers will find this a good readable resource of current actions.

Grobman, Arnold, ed., SOCIAL IMPLICATIONS OF BIOLOGICAL EDUCATION, National Association of Biology Teachers, 1971

Distinguished biologists were asked to prepare papers exhibiting their concern for significant social problems having a biological basis. These papers were then distributed to a panel who, at the 1969 NABT Convention, then entered into lively discussions with the biologists. The fields covered are medicine, behavior, genetics, population and evolution.

Excellent background reading for teachers who should go on to read the science fiction based on the projection of these social problems and to include both the facts and the science fiction in their courses. (T)

See Sauer VOYAGES on this booklist for some excellent references.

Hamilton, Michael P., ed., THIS LITTLE PLANET, Scribners, 1970

A fine and long-awaited juxtaposition of ecological and religious thought. Three scientists have written summary articles on three central aspects of the environmental problem -- pollution, scarcity, and man's place in nature in recent western thought -- to which three theologians respond. The theologians write from the viewpoint that the Church has a very special responsibility and opportunity for promoting environmental welfare and a sane view of man's proper place in nature. They have made a promising beginning at closing the uncalled-for-divide between Christian and ecological ethics.

Jaded readers who feel they have already read several thousand articles too many about "our environmental crisis," or "our ecological quagmire," may wish to read the theologians' articles only.

Hardin, Garrett, POPULATION, EVOLUTION, BIRTH CONTROL: A COLLAGE OF CONTROVERSIAL READINGS, W. H. Freeman & Co.

A unique collection of short readings. Statements of historical importance as well as recent statements and comments are included. Useful in any course dealing with the social impact of science whether taught in departments of biology, anthropology, economics, sociology, geography or others.

Harlow, William M., PATTERNS OF LIFE, Harper, 1966

The study of man's environment should certainly encompass art. Here is a collection of striking black and white photographs of plant life, as seen through a hand lens, that reveals the plan and symmetry of growing things. These plant patterns could provide students and teachers with new and exciting departures for creative expression. Material for mathematics is also here in the study of symmetry and spirals. See also Scheffer, THE SEEING EYE, Scribner, 1971.

Harrison, Gordon, EARTHKEEPING: THE WAR WITH NATURE AND A PROPOSAL FOR PEACE, Houghton-Mifflin, 1971

Here is a welcome change of emphasis that should provoke lively discussions. The author demonstrates that neither the population boom nor the advance of technology is to blame for our predicament. Rather we are in the mess we are in because our economic, political, and values systems, operating very well, are producing mess as part of their normal output. In conclusion he presents a plan for peace and tallies up the price we must be prepared to pay to achieve it. A must for teachers in every field, certainly of interest to eager students. The lengthy section of "Notes" at the end is an excellent source for further research.

Haskell, Elizabeth H. et al., MANAGING THE ENVIRONMENT: NINE STATES LOOK FOR NEW ANSWERS, Woodrow Wilson International Center for Scholars, 1971

The first phase in a study designed to determine how governmental institutions can be made more responsive to their citizen's increasing demands for pollution control and resource protection. This volume is an inventory and categorization of the "new answers." An evaluation will soon follow in another volume.

The text is smoothly written and is definitive in its field. The authors raise a number of questions of fundamental concern to serious environmentalists. Undoubtedly fuller answers to these questions will be provided in the second volume.

Herbert, Frank, DUNE, Ace Books, 1965.
DUNE MESSIAH, Berkeley Medallion Books, New York, 1969

Intrigue, terror, drama, and fantasy combine to make DUNE and its sequel DUNE MESSIAH, a treat for science fiction fanciers. But ecology buffs will be equally pleased since the planet Arrakis boasts a bizarre ecology, faithfully described in every detail by the author, and unusual economic and social arrangements and political machinations based on the utter and extreme scarcity of water. See notes on books by Grobman and Sauer on this list. Also in SOCIAL EDUCATION, December 1971, Vol. 35, No. 8, an essay by Ray Bradbury, noted science fiction author.

Hillcourt, William, NEW FIELD BOOK OF NATURE ACTIVITIES AND CONSERVATION, Putnam, 1970

Covers all aspects of nature study with countless detailed suggested activities and projects. A "Project Index" lists 400 additional projects particularly suited for group work, graded according to degree of knowledge, effort and equipment required.

Houston, James A., THE WHITE DAWN: AN ESKIMO SAGA, Harcourt, 1971

Excellent opportunity for the study of values in this novel depicting the changes in a culture brought about by the rescue of three white men.

Joffe, Joyce, CONSERVATION, Natural History Press, 1970

Emphasizes interrelationships and the necessity for man to apply ecological principles to his own species, in particular by stabilizing human populations. This is one volume in the Nature and Science Library published for the American Museum of Natural History. Original art, photographs, maps and charts -- many in full color -- amplify the text.

Johnson, Juey D., ed., NO DEPOSIT-NO RETURN: MAN AND HIS ENVIRONMENT: A VIEW TOWARD SURVIVAL, Addison-Wesley, 1970

This book is a collection of papers that grew out of a 1969 U. S. National Commission for UNESCO conference. It is intended to be a "primer for environmental awareness." Its object is both to inform and to rouse people to act." Leading experts from such fields as biology, architecture, city planning, sociology, advertising, and psychiatry participated. Each was asked to prepare a paper that would develop his own approach to the environmental dilemma, including suggestions for enlightened action. The latter are summarized in the last chapter. Teachers will find this book another excellent source of readings for an interdisciplinary approach to current problems.

La Farge , Oliver, LAUGHING BOY, Houghton Mifflin, 1963

The differences in the world view of the Indian and the white frontiersman are definitely expressed in this love story about a young Sioux brave, Laughing Boy, and his woman, Slim Girl, who has been raised in the white settlements. As Slim Girl attempts to re-enter tribal life, the irreconcilability of the Indian and white ways becomes increasingly clear.

Especially impressive is LaFarge's ability to transmit the meaning of a thousand small daily acts in the context of Indian beliefs about religion and nature.

Further reading: Borland, Hal, WHEN THE LEGENDS DIE; Ellis, Mel, WILD RUNNERS; Nomaday, N. Scott, HOUSE MADE OF DAWN.

Landsberg, Hans H., Leonard L. Fishman, and Joseph L. Fisher, RESOURCES IN AMERICA'S FUTURE: PATTERNS OF REQUIREMENTS AND AVAILABILITIES, 1960-2000, Johns Hopkins Press, Baltimore, 1963

To be used in conjunction with Committee on Resources and Man, National Academy of Sciences, RESOURCES AND MAN: A STUDY AND RECOMMENDATIONS, Freeman, 1969. Neither of these are nice books to cuddle up with on a lazy afternoon, but they do offer the most complete data on the state of our national resources published in single-volume form to date. Readers may merely wish to skim the tables and graphs (which calibrate the future balance between population and such resources as food, minerals and energy on land and in the sea), and ignore the text, or to take advantage of bonus sections on the human ecosystem, resource planning for the 100+ year future, and so on.

These books should be read in conjunction, since RESOURCES IN AMERICA'S FUTURE tends to choose the low population growth projections and the high resource availability projections, taking a correspondingly optimistic view of America's future, while RESOURCES AND MAN does the opposite. Both volumes gaze into the far future, but RESOURCES IN AMERICA'S FUTURE concentrates on the period prior to 2040, while RESOURCES AND MAN concentrates on the years before the year 2000. RESOURCES AND MAN examines the world resource picture, while RESOURCES IN AMERICA'S FUTURE largely confines itself to the American picture.

Laubin, Reginald and Gladys, THE INDIAN TIPI: ITS HISTORY, CONSTRUCTION AND USE, Ballantine, New York, 1971

Since this is the only comprehensive book on tipis, it is fortunate that it is accurately and gracefully written. Whether the reader wants diagrammatic advice on tipi building, or an understanding of the place of the tipi in the culture of the Plains Indians, he will appreciate this book. Included here because it fits in well with discussions of new life styles, an area every teacher should investigate. These will also help -- MOTHER EARTH NEWS (see Magazine list), WHOLE EARTH CATALOG, also Russell, R. and T., ON THE LOOSE and A. B. Laurel's LIVING ON THE EARTH.

Leinwand, Gerald, ed., AIR AND WATER POLLUTION, Washington Square Press, 1969

One in the PROBLEMS OF AMERICAN SOCIETY series that contains useful material for a very general introduction to the problems of air and water pollution. Easy reading.

Leopold, Aldo, SAND COUNTY ALMANAC: WITH OTHER ESSAYS ON CONSERVATION FROM ROUND RIVER, Oxford University Press, 1966

Undoubtedly one of the most quoted authors in the field of conservation. A collection of essays that points up the concept of American culture. To extend the analogy, students and teachers can also mine the riches of the lengthy annotated bibliography in this book.

Odum, Eugene P., ECOLOGY, Holt, 1963

Reviews the scope of ecology, structure and function of the ecosystem, ecological regulation, major ecosystems of the world. Influence of man both in and on ecological systems is stressed throughout text. Reading lists at ends of chapters.

Pringle, Laurence, ONE EARTH, MANY PEOPLE: THE CHALLENGE OF HUMAN POPULATION GROWTH, Macmillan, 1971

By graphs, figures, and photographs Mr. Pringle reinforces his concerns for the biological and ecological problems of over-population confronting us, while recognizing the position taken by some economists, engineers and others who differ with his point of view. He strongly poses the problems of a "quality" environment if populations trends continue unchecked.

Further reading: Joffe, Joyce, CONSERVATION, Natural History Press, 1970; Fisher, Tadd, OUR OVERCROWDED WORLD, Macmillan, 1969; Pringle, Laurence, ONLY EARTH WE HAVE, Macmillan, 1969.

Revelle, Roger and Hans H. Landsberg, eds., AMERICA'S CHANGING ENVIRONMENT, Houghton Mifflin, 1970

A collection of papers that comprehensively and excitingly challenges the traditional approach to problem solving. This collection views man in nature yet avoids the trap of using technology as the villain. It takes a bold step toward long-range answers. The proposals are thoughtul and well-documented. Compare with Harrison, EARTHKEEPING, cited earlier.

Rudofsky, Bernard, ARCHITECTURE WITHOUT ARCHITECTS, Doubleday, 1970

A glorious book, with many masterly photographs, showing how various primitive cultures the world over have designed and built homes and other structures which conform to the land, their ideas about nature, and their religions.

This volume would make an excellent companion to McHarg's DESIGN WITH NATURE.

Sauer, Rob, ed., foreword by Paul R. and Anne H. Erlich, VOYAGES: SCENARIOS FOR A SHIP CALLED EARTH, Ballantine, 1971

Famous authors, many of them writers of science fiction, bring to life in a series of short stories and vignettes the spectre of life on an over-populated planet. VOYAGES, with its striking illustrations of present and impending world problems related to the broad field of environment, complements books that describe the same problems in purely theoretical terms.

Brief bibliographies at the end of each story lead the reader to more excellent material.

SCIENCE YEAR: THE WORLD BOOK SCIENCE ANNUAL, Field Enterprises, 1971

This 1971 issue concentrates on environmental problems. There is a special three-part feature entitled THE FATE OF OUR LAKES which contains an excellent series of overlays demonstrating the process of eutrophication.

Many of the World Book articles are available as reprints which make useful teaching aids.

SCIENTIFIC AMERICAN - SCIENCE CONFLICT AND SOCIETY with introductions by Garrett Hardin, Freeman, 1969

Using this book is an ideal way for teachers to meet the increasing demand for more social relevance in the science curriculum. At the same time, SCIENCE, CONFLICT AND SOCIETY is an excellent demonstration of the usefulness of the scientific method in dealing with controversies. It includes pertinent book reviews and letters commenting on some of the articles.

SCIENTIFIC AMERICAN 39 STEPS TO BIOLOGY with introductions by Garrett Hardin, Freeman, 1968.

A collection of articles, with comments, from Scientific American on Adaptations, Behavior, Ecological and Social Problems.

Useful as a supplementary text for general biology courses. Includes important topics of a non-molecular nature often omitted in conventional biology courses.

Seymour, Whitney North, Jr., ed., SMALL URBAN SPACES, New York University Press, 1969

The philosophy, design, sociology and politics of vest-pocket parks and other small urban spaces. Here, particularly in the section on community action, are more possibilities for student projects. See also Allen, PLANNING FOR PLAY, cited earlier, and in the Curriculum Materials section, OUR MAN-MADE ENVIRONMENT.

Shepard, Paul and Daniel McKinley, THE SUBVERSIVE SCIENCE -- ESSAYS TOWARD AN ECOLOGY OF MAN, Houghton Mifflin, 1969

The authors have brought together in one volume a collection of searching and provocative essays on the ecology of man. The central theme is that the well-being of mankind is inescapably associated with a healthy, productive and attractive environment. The authors have put together in contemporary context, the thinking of some of the great scholars and students on the ecology of human populations. The section on "Additional Readings" is excellent.

Smith, Frank, E., POLITICS OF CONSERVATION, Random, 1966

A comprehensive study of the political history of conservation emphasizing its role in the development of the American government and economy. Bibliography at the end of text. See Davies, POLITICS OF POLLUTION, cited earlier.

Smith, Robert L., ECOLOGY AND FIELD BIOLOGY, West Virginia University, 1966

A college text in ecology, which is a valuable reference. Contains a multitude of illustrations, charts and diagrams, plus voluminous bibliographic references.

Sommer, Robert, PERSONAL SPACE: THE BEHAVIORAL BASIS OF DESIGN, Prentice-Hall, 1969

Designers too often base their structures on strictly aesthetic, legal or economic requirements rather than on genuine human needs.

In this highly readable volume, the author describes experiments conducted by him and his students, in the Psychology Department at the University of California at Davis, which reveal the process by which people mark out and personalize the spaces they inhabit.

Further reading: Hall, Edward, HIDDEN DIMENSION, Doubleday, 1966.

Storer, John, WEB OF LIFE, New American Library, 1956

Explains in simple language and with great clarity the complex term, "Balance of Nature."

Terry, Mark, TEACHING FOR SURVIVAL, Ballantine, 1971

Starting with the classroom, Mark Terry presents the ethical and practical means for transforming our educational system. The schools can become model environments themselves and thus serve as a central instrument for changing the society. (T)

Thomas, William L., Jr., ed., MAN'S ROLE IN CHANGING THE FAC EOF THE EARTH, University of Chicago Press, 1955.

This was the first large scale evaluation of what has happened and what is happening to the earth under man's impress. These papers focus viewpoints from nearly all fields of knowledge upon man's capacity to transform his physical-biological environment and upon his cumulative and irreversible alterations of the earth.

MAGAZINES AND NEWSLETTERS

AMERICAN FORESTS, American Forestry Association, 919 17th St., N. W.
Washington, D.C. 20006

$7.50/year subscription. Monthly, 65 pages: "For the advancement of intelligent management and use of our forests, soil, water, and wildlife, and all other natural resources necessary for an environment of high quality and the well-being of all citizens."

AUDUBON, National Audubon Society, 950 Third Avenue, New York NY 10022.

$10 with individual membership ($2 single copy) in Society "for the conservation and appreciation of wildlife and wilderness, natural resources and natural beauty." Bi-monthly, 130 pages noted for its excellence of material and color photography.

AWARENESS, Goff & Wagoner Nature Publications, 4031 Royer Road, Apt. 209,
Toledo, OH 43623

$3 subscription, 35¢ single copy. "New monthly publication designed for teachers, leaders and others who want to learn more about the out-of-doors and the techniques which help to make the out-of-doors more enjoyable and meaningful to others; especially children." 16 pages.

CATALYST FOR ENVIRONMENTAL QUALITY, 274 Madison Avenue, New York 10016.

$5 subscription, $4 per year for students. Quarterly, 36 pages, concerned with the total environment and aims "to help educate the people to the threats to their environmental well-being and the need for a change of attitude to quality rather than quantity values."

CLEAR CREEK, 617 Mission Street, San Francisco, CA 94105

$5/year subscription. Monthly. CLEAR CREEK directs itself "to uniting vision with fact, and daily living with universal concepts." Newspaper format and stock. Articles on current problems and new life styles.

THE CONSERVATIONIST, State of New York, Department of Environmental Conservation,
Albany, NY 12201

$2/year subscription, $5 for 3 years. Bi-monthly. Contents include students' page and How-To-Do-It series: This is probably the best magazine from a state Conservation Department.

CONSERVATION NEWS, National Wildlife Federation, 1412 16th St., NW.
Washington, D.C. 20036.

Free service made possible by contributions received for their wildlife conservation stamps. Bi-weekly, 15 pages. National issues highlighted.

DEFENDERS OF WILDLIFE NEWS, Defenders of Wildlife, 730 Dupont Circle Bldg.,
Washington, D.C. 20036

$5 with active membership in organization dedicated to the preservation of all forms of wildlife. Quarterly, 135 pages, a magazine of wildlife issues and educational articles (including predator control, endangered species, wildlife interests in Congress, extensive book reviews.)

DESIGN AND ENVIRONMENT, 6400 Goldsboro Road, N.W., Washington, D.C. 20034.

$11/year. Monthly. The interprofessional magazine for architects, engineers, city planners, landscape architects, and teachers and students investigating man and his environment, particularly urban.

ECOLOGY TODAY and ECOLOGY TODAY NEWSLETTER, Ecological Dimensions, Inc.,
P. O. Box 180, West Mystic, CT 06388

$6/year subscription. Monthly, 48-page magazine and 6-page newsletter, alternate.

EFFLUENT SOCIETY (an occasional newsletter), from Northeast Student Council on Pollution and the Environment (SCOPE), P. O. Box 8456, Boston, MA 02114

Free, 32 pages, includes regional and local news of environmental issues.

ENVIRONMENTAL ACTION, Environmental Action, Inc., Room 731, 1346 Connecticut Ave., N. W., Washington, D.C. 20036

$7.50 subscription or $10 membership in young activist organization which focuses concern upon the environmental crisis. Bi-weekly, 15 pages, packed with in-depth information on national issues.

FOXFIRE, Rabun Gap, GA 30568

$5/year. Quarterly. Foxfire is produced by a group of Appalachian high schoolers who wanted to know and to tell others, how their grandparents made it before the advent of modern technology. In search of a fading culture they scout the surrounding hills with cameras and tape recorders, finding senior citizens eager to relate and demonstrate mountain religion, life ways, and survival skills. With the help of the "Rabun Gap Outriders", a group of Puerto Rican students at a lower east side high school in New York have founded a kindred journal, the Fourth I, soon to be joined by a journal by American Indian students.

HUMANITIES, National Endowment for the Humanities, Washington, D.C. 20506

A most interesting quarterly newsletter that will alert the teacher to new ways of incorporating the humanities into environmental education.

THE JOURNAL OF ENVIRONMENTAL EDUCATION, Dembar Educational Research Services, Box 1605, Madison, WI 53701

$10/subscription, $5 for students, $2 single copy. Quarterly, 48 pages, black & white, no photographs, "Devoted to research and development in conservation communications." Vital addition to professional libraries in every school.

THE LIVING WILDERNESS, The Wilderness Society, 729 15th Street, N. W., Washington, D.C. 20005

$7.50 with membership, $4 to schools, libraries and students, $1 single copy. Society is incorporated to secure the preservation of wilderness. Its "long-time broad purpose is to increase the knowledge and appreciation of wilderness, wherever found, and to see established enduring policies and programs for its protection and appropriate use." Quarterly, 45 pages.

MEDIA AND METHODS, 134 N. Thirteenth Street, Philadelphia, PA 19107

$5/year monthly, September-May. This periodical (formerly EDUCATOR'S GUIDE TO MEDIA & METHODS) offers sound media reviews and information, with articles that seek to startle the staid.

MELANCHOLY ACCIDENT, Mid-Atlantic Student Council on Pollution and the Environment (SCOPE), Box 5071, Richmond, VA 23220

Free, monthly. Includes regional and local news of environmental issues.

THE MOTHER EARTH NEWS, P. O. Box 38, Madison, OH 44057

$5/year subscription, $1 single copy. Bi-monthly, 99 pages, black and white; "edited by, and expressly for, today's influential 'hip' young adults. The creative people. The doers. The ones who make it all happen. Heavy emphasis is placed on alternative life styles, ecology, working with nature and doing more with less."

NATIONAL GEOGRAPHIC, National Geographic Society, 17th & M Streets, Washington, D.C. 20036

$9/year, $1 single copy. Monthly. Special December issue OUR ECOLOGICAL CRISIS, especially valuable.

NATIONAL PARKS AND CONSERVATION MAGAZINE, National Parks & Conservation Assn., 1701 18th Street, N.W., Washington, D.C. 20009

$10/year with Associate membership, $8 student membership, $1 single copy. This association has "responsibilities primarily in protecting the National Parks and Monuments of America, in which it endeavors to cooperate with the National Park Service while functioning as a constructive critic, and to protecting and restoring the whole environment." Monthly, 40 pages, black-and-white.

NATIONAL WILDLIFE, National Wildlife Federation, 1412 16th Street, NW. Washington, D.C. 20036

$6.50/year with associate membership in organization dedicated "to create and encourage an awareness among the people of this nation of the need for wise use and proper management of those resources of the earth upon which the lives and welfare of man depend: the soil, the water, the forests, the minerals, the plant life and the wildlife." Bi-monthly, 55 pages, noted for many color photographs. Environmental Education materials available, also kit for National Wildlife Week. "Ideas for Learning", a teacher's guide to National Wildlife is now being published. NWF also publishes International Wildlife, similar in format and with "Ideas for Learning" guide free to teachers.

OUR PUBLIC LANDS, official publication of the Bureau of Land Management, U.S. Department of Interior.

$1.00/year or 25¢ each from the U.S. Government Printing Office, Washington, D.C. 20402. Quarterly, 22 pages, black and white.

OUTDOOR NEWS BULLETIN, Wildlife Management Institute, 709 Wire Building, Washington, D.C. 20005

Free, bi-weekly, 6 pages, national issues covered.

POPULATION BULLETIN, Population Reference Bureau, Inc., 1755 Massachusetts Ave., Washington, D.C. 20036

$5/year, $6 per year as part of membership. Contains perceptive studies of important problems of expanding population.

POPULATION CHRONICLE, Population Council, 245 Park Ave., New York, NY 10017

Free, 4 to 6 times a year covers a broad field of population and family planning in brief, non-technical terms.

RODALE'S ENVIRONMENT ACTION BULLETIN, Rodale Press, Inc., Emmaus, PA 18049

$10/year subscription, $5 for 6 months. Weekly coverage of health and human ecology news, 8 pages. Includes an "Eco-Action" section to get the reader directly involved in doing something concrete for the betterment of the environment. "If you do nothing else, try to carry through that project," which may be clipping and mailing coupons to senators on national issues, planting a tree or cooking an organic dinner.

THIS MAGAZINE IS ABOUT SCHOOLS, 56 Esplanade Street East, Suite 301, Toronto 215, Ontario, Canada

$4 subscription in United States, $1 single copy. Quarterly, 160 pages, innovative educational thought.

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American Education Publications, Xerox Education Group, Education Center, Columbus, OH 43216
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ERIC Clearinghouse, Science and Mathematics Education, The Ohio State University, Columbus, OH 43221
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Oxford University Press, Inc., 200 Madison Avenue, New York, NY 10016
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Planned Parenthood-World Population, 810 Seventh Avenue, New York, NY 10019
Pocket Books, Inc., 630 Fifth Avenue, New York, NY 10020

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Washington Square Press (See Pocket Books)
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Whole Earth Catalog, 558 Santa Cruz Avenue, Menlo Park, CA 94025
Wilson Library, Western Washington State College, Bellingham, WA 98225
Woodrow Wilson International Center for Scholars, Washington, D.C. 20560
Wright-Allen Press, Inc., 238 Main Street, Cambridge, MA 02142

Educational Materials Available

Environmental Films Available at Purdue University Audio-Visual Center

Symbols

CS - color sound
BS or B/WS - black and white sound
E - elementary
J - junior high school
S - senior high school
C - college
A - adult

Adventures of Junior Raindrop (soil erosion)				
USDA	E	6 min.	CS	$1.25
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USDA	SCA	14 min.	CS	1.25
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Color the City Green WJKL	JSCA	30 min.	CS	1.25
Continental Drift MFBC	CA	10 min.	CS	0.00
Cottontail (agriculture, wildlife and man) USDA	JSCA	53 min.	CS	10.00
Deep Waters (ground water resource and development) Layne	SCA	25 min.	CS	1.25
Deer Family of North America IFB	JSCA	18 min.	CS	1.25
Desalting the Seas USAEC	SCA	15 min.	CS	1.25
Drowning Bay (San Francisco bay problems) KINGSP	ESSCA	9 min.	CS	0.00
The Dust Is Dying (wind erosion) USDA	SCA	14 min.	CS	1.25
The Earth (poles, longitudes, latitudes, etc.) USN	C	17 min.	B/WS	1.50
The Earth in Motion EBE	SCA	12 min.	B/WS	1.75
Earth is the Lord's (stewardship) USDA	SCA	13 min.	CS	1.50

Ecology of Pronghorn, Mountain Sheep and Mountain Goats	IFB	JSCA	15 min.	CS	2.75
The Enemy Below (soil pests)	SOC	SCA	15 min.	CS	1.25
Erosion	USDA	ES	5 min.	B/W	1.25
The Eternal Forest	USDA	JSCA	20 min.	CS	4.25
Everyman's Empire	USFS	JSCA	18 min.	CS	2.00
Fallout and Agriculture (nuclear fallout)	USDA	SCA	23 min.	CS	1.25
Farm Boys'Forestry Camp	PURDUE	S	11 min.	B/WS	2.00
500,000 to 1 (insect diversity and control)	USDA	SCA	22 min.	CS	3.00
Forest, The	USDA	SCA	28 min.	CS	1.25
Forest Patterns	USDA	SCA	20 min.	CS	2.00
Friendly Waters (watershed manipulation to control flooding)	USDA	CA	7 min.	CS	1.25
From the Ground Up	USDA	SA	13 min.	CS	2.00
From the Ridge to the River (watershed and people)	USDA	SCA	22 min.	CS	3.25
From Trees to Lumber	AFPI	JSCA	14 min.	B/WS	1.25
From Trees to Paper	AFPI	JSCA	12 min.	B/WS	1.25
Garbage Explosion	EBEC	SCA	16 min.	CS	8.25
Garden Insects	Jenkins	SCA	27 min.	CS	4.50

Geological Work of Ice				
EBE	SCA	11 min.	B/WS	1.50
Geology of Yellowstone				
WAF	JSCA	15 min.	CS	6.25
The Gifts (land and water pollution)				
USBSFW	SCA	28 min.	CS	0.00
Glacier National Park				
JOHNALLEN	EJSCA	14 min.	B/WS	3.50
Golden Secret, The				
USDA	E	7 min.	CS	2.00
Grass -- The Big Story				
USDA	SCA	28 min.	CS	2.00
Grass Down Field Waterways				
UNEBR	SA	8 min.	CS	1.25
Grass Roots in the Soil				
Iowa	SCA	19 min.	CS	1.25
The Great Lakes Area -- Men, Minerals, and Machines				
MGHT	JSCA	15 min.	CS	1.25
Greatest Good (forest conservation)				
USDA	JSCA	10 min.	CS	1.25
Greener Hills for Southern Indiana				
PURDUE	SCA	13 min.	CS	6.00
Hello Darwin (nature study)				
UALP	CA	48 min.	CS	0.00
The Hardwoods (forest management in Indiana)				
Purdue	SCA	20 min.	CS	1.25
Headwaters (watersheds)				
MOCC	CA	20 min.	CS	4.25
Health Hazards of Pesticides				
USG	CA	14 min.	CS	3.00
Heredity and Environment				
CORONET	SCA	11 min.	B/WS	1.75
Heritage of Splendor (recreation areas and litter)				
Higgin	JSCA	18 min.	CS	3.00
Heritage We Guard (wildlife and soils)				
USDA	JSCA	30 min.	B/WS	1.25

Heroic Materialism (cultural systems)	BBC	SCA	52 min.	CS	0.00
Herring Gull Behavior (wildlife)	EDC	EJSCA	10 min.	CS	0.00
Hidden Kingdom (Sahara Desert and peoples)	TIMEI	JSCA	25 min.	CS	0.00
High Over the Border	INTAM	SCA	20 min.	B/WS	2.00
History Layer by Layer (Grand Canyon)	MGHT	CA	20 min.	CS	8.00
Honkers Prepaid	Olin Math	SCA	21 min.	CS	1.25
Horntail Wasp -- Thief Parasite (Super 8 mm)	HARW	SCA	4 min.	CS	0.00
How to Keep What We Have (how we live in America #7)	AEF	JSCA	11 min.	BS	0.00
How We Got What We Have (#1)	AEF	JSCA	22 min.	BS	0.00
Hunters, The (Parts I, II, & III) (Bushmen life style)	Con	CA	73 min.	CS	12.00
Hunters of the North Pole	SF	EJSA	11 min.	B/WS	3.50
The Industrial City (urban decay)	EBE	EJ	16 min.	CS	6.00
Iroquois Watershed	Purdue	SCA	18 min.	CS	4.75
It's a Tree Country	AFPI	JSCA	14 min.	B/WS	1.25
It's Your Decision -- Clean Water	SOAP	SCA	14 min.	CS	1.25
John Wesley Powell -- Canyon Geologist	BYRON	JSCA	21 min.	CS	0.00

Land of the Red Goat				
NFBC	JSA	20 min.	CS	1.25
Let's Keep America Beautiful (litter)				
KABI	JSCA	14 min.	CS	2.75
Level Farming on Sloping Fields				
CASE	SA	11 min.	B/WS	2.00
The Life Cycle of the Salmon				
UEVA	JSCA	10 min.	CS	0.00
Life in a Woodlot				
MGHT	SCA	17 min.	CS	5.50
Life of a Primitive People (Africa) (Anthropology)				
CORONET	E	13 min.	B/WS	3.00
Life Zones of the Central Rockies				
IFB	JSCA	22 min.	CS	1.25
Lifeblood of the Land (water)				
USDA	JCA	18 min.	CS	1.25
Lifelines of Civilization (water)				
ACPA	SCA	25 min.	CS	1.25
Living City, The (urban decay)				
EBE	SCA	25 min.	B/WS	3.25
Man's Problem (water)				
USDA	JS	19 min.	CS	1.50
Maps and their Meaning (coastal areas)				
ACA	EJ	20 min.	CS	0.00
Micro-organisms -- Beneficial Activities (N_2 cycle)				
10	CA	15 min.	CS	4.50
Mosquito Fighters (insect control)				
STOKG	EJ	21 min.	CS	0.00
1985, Parts I, II, and III (trends of 1970 projected to 1985)				
CCM	JSCA	56 min.	CS	0.00
Nitrogen Abundance				
ALLIED	SCA	15 min.	CS	2.00
Nitrogen Cycle				
EBF	SC	15 min.	B/WS	3.50

No Room for Wilderness (wildlife, resources and man)	CCM	JSCA	25 min.	CS	0.00
Ocala (regional development)	USFS	JSCA	10 min.	B/WS	1.50
Once Upon a Time (forestry and wildlife)	USDA	SA	11 min.	B/W silent	1.25
Our Land -- Its Many Faces	USDA	SCA	14 min.	CS	1.25
Paper Forest, The	WILLRD	SCA	28 min.	CS	4.75
Patterns of the Wild (wildlife)	USBSFW	EJSCA	26 min.	CS	1.25
Pest or Plenty	USDA	SCA	13 min.	CS	1.25
Planning for Tomorrow	USDA	SCA	11 min.	CS	2.00
Plowshare (nuclear energy and uses)	USAEC	CA	28 min.	CS	1.25
Prescribed Burning in the South	USDA	CA	23 min.	CS	1.25
Rain on the Plains	USDA	JSCA	9 min.	B/WS	1.25
Raindrops and Soil Erosion	USDA	CA	20 min.	CS	1.25
Realm of the Wild	USDA	JSCA	28 min.	CS	1.25
Recent Carbonate Deposits of the Florida Keys (coral deposits and formation)	SWFL	SCA	36 min.	CS	5.50
Return to Eden (soil conservation)	ALLIS	SCA	15 min.	CS	3.00
River, The (Mississippi)	USDA	JSCA	32 min.	B/WS	3.50

The River Nile (Aswan Dam, etc.)	NBCTV	SCA	34 min.	CS	0.00
Safe Use of Pesticides	USDA	SCA	22 min.	CS	1.25
Save the Soil	USDA	SCA	10 min.	B/WS	2.00
Seeds of Destruction (soil conservation)	EBF	JSC	9 min.	CS	3.00
Silent Killer	USDA	SCA	12 min.	CS	2.00
Social Animal, The (anthropology)	NET	CA	29 min.	B/WS	4.50
Soil Test	PURDUE	SCA	22 min.	CS	2.00
Soil and Water Conservation	USDA	ES	11 min.	CS	1.25
So Little Time (wildlife destruction)	USBSFW	JSCA	28 min.	CS	1.25
Solar Radiation I -- Sun and Earth	AMS	SCA	18 min.	CS	4.25
Solar Radiation II -- The Earth's Atmosphere	AMS	CA	21 min.	CS	8.00
Spruce Bog, The	MGHT	SCA	23 min.	CS	9.50
The Story of the Mourning Dove	MOCC	JSCA	38 min.	CS	9.25
Succession -- From Sand Dune to Forest	EBF	SC	16 min.	CS	5.50
Textures of the Great Lakes	THORNE	SCA	14 min.	CS	4.25
This Is The Mallard	PURDUE	SCA	43 min.	CS	2.00
This Land Is Ours	USDA	SCA	28 min.	CS	2.00

Time of Wonder (nature study)	WWOOD	E	13 min.	CS	4.00
Tiskilwa Story, The	USDA	CA	13 min.	CS	2.00
To Conserve Our Heritage (history of resource waste)	MINNMC	JSCA	25 min.	CS	4.50
Top Soil	USDA	ES	10 min.	B/WS	2.00
Tragedy of the Commons	KINGSP/HRAW	EJSCA	23 min.	CS	11.00
Treehouse (boy against development)	KINGSP	EJSCA	9 min.	CS	0.00
Trees for the Future	PURDUE	JSCA	15 min.	CS	1.25
Trees for Tomorrow	AFPI	JSCA	15 min.	B/WS	2.00
Tropical Africa (cultural changes)	IFF	JSCA	29 min.	CS	8.25
Trouble with Trash (solid wastes)	CTRACT	SCA	30 min.	CS	0.00
Volcano Surtsey	NSN	EJSCA	26 min.	CS	9.00
Water for Farm and City	USDA	JSA	13 min.	B/WS	2.00
Watershed	USDA	A	22 min.	CS	1.25
Weather Ahead (weather forecasting)	PURDUE	SCA	10 min.	CS	1.25
We're On Our Way	EKC	JSCA	26 min.	CS	2.00
We Explore the Field and Meadow	CORONET	E	11 min.	CS	3.50
We Explore the Woodland	CORONET	E	11 min.	CS	3.00

We Share This Land				
USDA	ESA	14 min.	CS	1.25
What Can You Find?				
LOH	EJC	12 min.	CS	4.25
Who Shall Reap? (man against pests)				
USDA	SCA	30 min.	SC	1.25
Wild Fowl in Slow Motion				
STERLING	PEJS	10 min.	B/WS	3.50
Wild Wings				
IFB	SCA	35 min.	CS	8.50
Wilderness Trail				
USDA	JSCA	15 min.	CS	1.25
Wildlife and the Human Touch				
USAA	JSA	19 min.	CS	3.00
Woodworkers				
AFL-CIO	SCA	14 min.	B/WS	2.00
World at Your Feet (soil structure)				
USDA	A	22 min.	CS	1.25
Yours Is The Land (interdependence of resources)				
NCF	CA	20 min.	CS	1.25

Slide Sets

Agriculture and the Changing Environment			
USDA	JSCA	CS	1.25
Cloudburst			
CTRACT	JSCA	CS	4.70
Conserving Our Natural Resources			
PUCES	SCA	C	2.00
Ecology of Plants			
PUAVC	SCA	CS	2.00
4-H Wildlife Projects			
PUCES	EJSCA	CS	2.00
The Need for Small Watershed Protection			
CTRACT	SCA	C	2.00

Educational Materials Available

Environmental Films Available at Wabash Valley Education Center

Symbols:
C - color
B/W - black and white
p - primary
i - intermediate
j - junior high school
s - senior high school

Agriculture, Research and You	FF120610	18 min.	C	s	Farm Film Found.
Air is for Breathing	FF120642	29 min.	C	j/s	Shell
Air Pollution	F40559	12 min.	C	j/s	JF
Air Pollution: Take a Deep Deadly Breath -- Parts I, II and III	F80489 A, B, C	54 min.	C	j/s	McG
Alaska Speaks	F80807	15 min.	C	i/j/s	AM
The American Spectacle	F120257	34 min.	C	i/j/s	McG
Animals Eat in Many Ways	F40655	9 min.	C	p/i	BFA
Autumn (Tales of the Riverbank Series)	F80758	14 min.	B/W	p	McG
Birds in the City: A First Film	F40651	10 min.	C	p/i	BFA
Birds in Your Backyard	F40539	11 min.	C	p/i	AB
Boomsville	F40602	11 min.	C	i/j/s	LCA
Build a Better Mousetrap	F120173	24 min.	C	i/j/s	McG
Changing City	F80589	16 min.	B/W	i/j/s	He

Chicago-Midland Metropolis	F120404	22 min.	C	j/s	EBF
Chicks and Chickens	F40591	10 min.	C	p/i	FI
The Cities -- A City is to Live In	F120584 A, B	54 min.	C	j/s	BFA
Cities and Beauty	F40446	8 min.	C	p	McG
Cities and Geography	F40464	10 min.	C	p	McG
Cities and History	F40461	8 min.	C	p	McG
Cities in Crisis: What's Happening?	F80879	21 min.	C	j/s	U
Cities of the Future	F120456	25 min.	C	i/j/s	McG
Conservation: Job for Young America	F80189	19 min.	C	i	McG
Conserving Our Mineral Resources Today	F40380	11 min.	C	i/j	Cor
Crow Boy	F60057	13 min.	C	p/i	WW
Elsa and Her Cubs	F120621	31 min.	C	i/j/s	BE
Eskimo Summer	F80730	16 min.	C	i/j/s	IFB
First Mile Up	F120320	28 min.	B/W	j/s	McG
The Futurists	F120455	25 min.	C	i/j/s	McG
Getting Acquainted with Birds in the Fields	F60041	13 min.	C	p/i	CCM
Growing, Growing	F40648	11 min.	C	p/i	CH

Haiku	F40649	7 min.	C	i/j/s	dxf
Heritage of Splendor	F80587	18 min.	C	i/j/s	He
Horses	F40577	7 min.	C	p/i/j/s	TR
House of Man -- Our Changing Environment	F80418	17 min.	C	i/j/s	EBF
How Does a Garden Grow	F40631	11 min.	C	p/i	BFA
The Kingfisher	F80661	15 min.	C	i/j/s	ACI
A Land Betrayed	F40485	10 min.	C	p/i/j/s	He
Learning About Leaves	F40593	11 min.	C	p	Cor
Life On a Dead Tree	F40630	11 min.	C	p/i	BFA
The Litter Monster	F80737	16 min.	C	i/j/s	ACI
Man Uses and Changes the Land	F40392	11 min.	C	p/i	Cor
Monarch Butterfly Story	F80643	11 min.	C	i	EBF
A Nation of Spoilers	F40474	11 min.	C	i/j/s	He
1985	F80738 A, B, C	56 min.	C	j/s	CCM
Of Broccoli & Pelicans & Celery & Seals	F120619	30 min.	C	j/s	IU
The Ohio River -- Background for Social Studies	F40376	11 min.	C	i/j/s	Cor
Our Endangered Wildlife, Parts I & II	F120589 A, B	51 min.	C	j/s	McG

Our Part in Conservation				
F40200	11 min.	C	i	McG
Our Vanishing Land				
F120477	24 min.	C	i/j/s	McG
Over in the Meadow				
F40527	9 min.	C	p	WW
People by the Billions				
F120587	28 min.	C	j/s	McG
The Persistent Seed				
F80035	14 min.	C	s	Cor
Population Ecology (2 different films)				
F80310	21 min.	C	j/s	EBF
F120122	28 min.	C	s	McG
Problems of Conservation -- Air				
F80740	15 min.	C	j/s	EBF
The Problem with Water is People				
F120146	20 min.	C	i/j/s	McG
Progress, Pork Barrel & Pheasant Feathers				
F120494	27 min.	B/W	i/j/s	Ct
Pure and Simple				
FF80788	18 min.	C	j/s	Link-Belt
Reflections in a Pond				
F40558	10 min.	C	p/i/j/s	JF
The Seasons				
F80809	17 min.	C	p/i/j/s	AM
Spring Is Here				
F40637	9 min.	C	p/i	
Standing Room Only				
F120398	25 min.	C	i/j/s	McG
Take Time to See				
F40665	10 min.	C	p/i/j/s	AB
Time of Wonder				
F60032	13 min.	C	p	WW

To Clear the Air	FF80561	22 min.	C	i/j/s	American Petroleum Institute
Treasures of the Earth	F40588	11 min.	C	i	CH
Trees and Their Importance	F80321	12 min.	C	i	EBF
U. S. Route #1 -- American Profile	F120214 A, B	54 min.	C	j/s	McG
Water for the City	F40777	11 min.	C	p/i	BFA
Waterfowl -- A Resource in Danger	F80288	17 min.	C	i	EBF
What Do Flowers Do: A First Film	F40566	11 min.	C	p/i/j	
Where Does Our Food Come From?	F40598	11 min.	C	p/i	
Winter is Here	F40636	9 min.	C	p/i	IFB
Wonders in Your Own Backyard	F40587	11 min.	C	p/i	CH
Yellowstone, Our First National Park: Its Geology, History and Beauty	F80720	19 min.	C	i/j/s	BFA
Yosemite National Park: Its Geology, History and Beauty	F80720	19 min.	C	i/j/s	BFA
Zoos of the World	F120629	52 min.	C	i/j/s	

Science Approaches:

Above the Timberline -- The Alpine Tundra Zone	F80140	16 min.	C	j/s	McG
Adaptation in Animals	F80134	16 min.	C	j/s	McG
Adaptation to Marine Environment	F80644	19 min.	C	s	McG

Air and What It Does	F80324	11 min.	C	p	EBF
Air All-Around	F40199	8 min.	C	p	McG
Air All Around Us	F40468	11 min.	C	i	McG
The Animal and the Environment	F120074	28 min.	C	s	McG
Animal Communities and Groups	F40443	11 min.	B/W	p/i	Cor
Antarctica: The Cold Frontier	F80176	15 min.	C	i/j	McG
The Beginning and Development of Life (Evolution of Life Series)	F80754	15 min.	C	i/j	McG
Boy's Trip into the Grand Canyon	F80678	15 min.	C	i	JF
Brazil: Change Comes to the Rain Forest	F80689	19 min.	C	i/j/s	U
The Cave Community	F80322	13 min.	C	j/s	EBF
The Coming of Man (Evolution of Life Series)	F80750	13 min.	C	i/j	McG
The Deciduous Forest	F120127	28 min.	C	s	McG
The Desert	F120354	22 min.	C	j/s	EBF
The Desert Community	F80502	12 min.	C	i	EBF
Development	F120058	28 min.	C	s	McG
Discovering the Forest	F80290	28 min.	C	s	McG
Distribution of Plants and Animals	F120108	28 min.	C	s	McG

Erosion -- Leveling the Land F80279	14 min.	C	i/j/s	EBF
The Forest Guards Our Water Supply F40812	11 min.	C	p/i	U
The Forest is Home to Wildlife F40814	11 min.	C	p/i	U
Full Fathom Five F40413	8 min.	C	i/j/s	PY
Fun in the Forest F40813	11 min.	C	p/i	U
Geography of the Pacific States F40618	11 min.	C	i/j/s	Cor
Geography of the Southern States F40627	11 min.	C	i/j/s	Cor
Geography of the Southwestern States F40628	11 min.	C	i/j/s	Cor
Geology of the Grand Canyon Country F80461	17 min.	C	i/j	BFA
Grand Canyon F120486	29 min.	C	i/j/s	Dis
The Grasslands F80352	17 min.	C	j/s	EBF
How Animals Help Us F40140	12 min.	C	i	McG
How Plants Help Us F80117	12 min.	C	i	McG
The Hunter and the Forest F40233	8 min.	B/W	i/j/s	EBF
Journey to the High Arctic F120575 A, B	51 min.	C	i/j/s	FI
Life Beside the Sea F40520	8 min.	B/W	i/j/s	McG
Life Between Tides F80286	11 min.	C	i	EBF
Life in the Woodlot F80238	17 min.	C	j/s	McG

Life on the Tundra F80303	14 min.	C	i	EBF
Life Under the Sea F80734	16 min.	C	i/j/s	ACI
Limiting Factors F120124	28 min.	C	s	McG
Looking Like What You're Not (Wonders of the Sea Series) F120593	24 min.	C	i/j	ST
Marine Ecology F120126	28 min.	C	s	McG
The Marsh Community F80284	11 min.	C	i	EBF
Message from a Dinosaur F80365	11 min.	C	i	EBF
Microbes and their Control F80772	13 min.	C	p/i/j	BFA
Mountains F40548*	9 min.	C	p/i/j	IU
Nature's Half Acre F120342	33 min.	C	p/i/j/s	Dis
Oceanography: A Study of Oceans F80683	15 min.	C	i/j/s	JF
Oceanography -- A Voyage to Discovery F80686	20 min.	C	j/s	
The Physical Environment F80295	11 min.	C	s	EBF
Rocks for Beginners F80735	16 min.	C	i/j	MLA
Science for Beginners F40612	11 min.	C	p	Cor
The Sea F120351	26 min.	C	j/s	EBF
The Seashore -- Pacific Coast F40544	10 min.	C	i/j	AB

The Secret of Life				
F120474	24 min.	C	s	McG
The Spruce Bog				
F120199	26 min.	C	j/s	McG
The Temperate Deciduous Forest				
F80323	17 min.	C	j/s	EBF
Trees and Their Importance				
F80321	12 min.	C	i	EBF
The Tropical Rain Forest (2 different films)				
F80330	17 min.	C	j/s	EBF
F120128	28 min.	C	s	McG
Tundra Ecology				
F120129	28 min.	C	s	McG
Understanding Our Earth: Soil				
F40607	11 min.	C	p/i/j	Cor
Water Harvesting				
F80595	15 min.	C	i/j	He
Waterfowl -- A Resource in Danger				
F80288	17 min.	C	i	EBF
Whatever the Weather				
F40745	10 min.	C	p	EBF
What Is Ecology?				
F80361	11 min.	C	s	EBF
The World Around Us				
F120252	24 min.	C	i/j/s	McG

Filmloops

FLO-56	The Kangaroo	p/i
FLO-57	Birds Feeding Their Young	p/i
FLO-58	Diving Spider	p/i
FLO-59	Brown Bear -- Mother and Cubs	p/i